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MAY 1918

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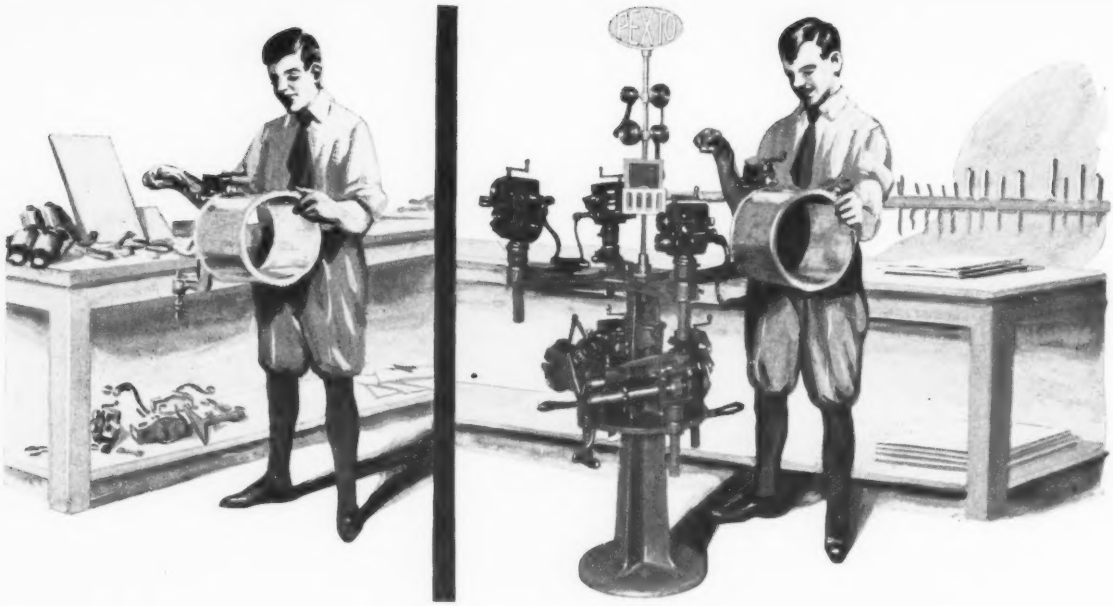

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Published Monthly by

THE BRUCE PUBLISHING COMPANY, Milwaukee, Wis.

Established 1891

FRANK M. BRUCE, Publisher

W. J. LAKE, Eastern Advertising Manager — E. E. KRILL, Business Manager — H. KASTEN, Subscription Manager

OFFICES

MILWAUKEE: 129 MICHIGAN ST. — New York: 1 Madison Ave. — Chicago: 64 W. Randolph St.

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Entered January 20, 1914, as second-class matter in the Postoffice at Milwaukee, Wis., under the Act of March 3, 1879.

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Member of the Associated Business Papers and Audit Bureau of Circulations.

SUBSCRIPTION INFORMATION.

The subscription price of the *Magazine* is $1.50 per year, payable in advance. Postage for Canadian and Mexican subscriptions, 35 cents; for foreign countries, 50 cents. Single copies, not over six months old, 25 cents; more than six months old, 50 cents. Notice for discontinuance of subscriptions must reach the Publication Office in Milwaukee, at least fifteen days before date of expiration, with full balance due to date. Notices for changes of address should invariably include the old as well as the new form of address. Complaints of non-receipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

EDITORIAL CONTRIBUTIONS.

The Board of Editors invites contributions of all kinds bearing upon the Industrial-Arts Education, Manual Training, Art Instruction, Domestic Science, and related subjects. Unless otherwise arranged for, manuscripts, drawings, projects, news articles, etc., should be sent to the Publication Office in Milwaukee, where proper disposition will be made. The Board of Editors meets once or oftener each month in Chicago, and all contributions submitted are given careful attention. Contributions when accepted are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

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Vol. VII MAY, 1918 No. 5

Applied Mechanics for Vocational Schools

Louis A. Bell, Instructor of Applied Science, David Ranken, Jr. Trade School, St. Louis

IT is my firm belief that a course in physics can be so reorganized and presented as to be a real contribution to the new educational movement—the vocational idea, without impairing the disciplinary or formal value of the subject.

As an instructor of applied science at the Ranken School, St. Louis, I have had some experience in the reorganization and presentation of these subjects with the idea of usefulness and practicability foremost in my mind. There is so much room for practical demonstrations and applications in the teaching of these subjects—especially applied mechanics, that there is no field more fertile for the "new idea" to take root.

Dr. W. W. Charters, of the University of Illinois, in his book on methods of teaching seems to dwell upon one central idea: "the intrinsic function of subject matter in contrast with the importance of the *Control of Values.*" In other words, information is of little value to us unless we make the best use of it at the proper time and under the proper circumstances. The teacher must guide the pupil in the proper control of values, that is, useful values.

Government statistics tend to show that the teaching of the physical sciences in our public schools is on the decline, especially in the high schools. That this should be true in spite of the great advancement which applied science is making in the industrial world is a fact of which every teacher of these subjects should take note. The chief causes of this situation, especially in the teaching of physics, lie in the method of presentation, in the kind of laboratory work required of pupils, and the impractical equipment with which this work is performed. This results in a lack of proper interest on the part of the student, and a failure in results obtained.

In the organization of courses in any subject, the following principles should be adhered to, namely: (1) that interest is the primary factor resulting in spontaneous effort, (2) that interest is brought into being by consulting the students' experiences outside of the school, and associating them with the subject matter—leading from known to unknown, and (3) that the usefulness of the subject matter is a measure of the interest and effort of the student.

Five years' experience in the application of these principles to my courses has demonstrated their soundness in actual results obtained. Additional evidence of their soundness can be found in the analysis of a student's feelings toward any formal course. A scientific principle or mathematical process is grasped much more readily if it is presented in connection with student experience and practical problems; more effort and real thinking are brought into being thru practical applications than thru abstractions and formalities.

Instruction in applied mechanics should be given under the following three divisions: (1) Carefully selected topics for lecture and recitation should be taken up, neither necessarily in book order nor from any one textbook. In each topic the formal presentation of laws, principles, and formulae should be preceded and stimulated by discussions of daily experiences, and these discussions will lead to the formulation of problems. The working of the problems develops the principles and laws, and likewise gives practice in elementary mathematics. (2) When a topic has been presented in the above manner, the useful phase of the topic should be augmented by practical demonstrations before the class. These demonstrations then present a background for a list of carefully selected and original problems, referring especially to things with which the student is familiar. From this list should be omitted the problems handed down from generation to generation and long ago worn threadbare. It is here that the teacher can use his originality in the formation of new problems. This means personal trips by the teacher as well as class trips to shops and factories. (3) The completion of the problem work prepares the class for laboratory or experimental work. Laboratory work must be carefully designed so that it will appeal to students as actually associated with useful things about them. The equipment used must always be of a practical and commercial type, as I feel that the more formal apparatus manufactured by scientific companies tends to detract from the useful aspect of the experiment. These experiments should be designed to supplement the lecture and problem work on the topic and at the same time to instruct in daily practical necessities.

The best phase of the practical presentation of topics rests with the laboratory work when properly conducted. Most of the blame for poor results in science teaching can be laid to poorly conducted laboratory work. The student should naturally be interested most in that which he does. We are justified in expecting much of laboratory work, for thinkers have long ago admitted, and experience has shown, that the vital pleasures in life are those derived thru man's handiwork. It is no wonder, then, that students are interested in those things which are instruments or tools for the realization of their daily problems and adjustments. The principles which should govern the organization and presentation of applied mechanics have been stated. The actual presentation of the topics in three divisions so as to make the useful factor a predominating one has been explained. Following is a discussion of some of the more common and useful subjects in mechanics:

No subject should be approached from the same angle for two different classes of students, and this is especially true in the teaching of leverage. The method of presentation—inductive-deductive, known to unknown— should be the same for each class of students, but the topic which starts and motivates the class discussion should differ. Students of household vocations will naturally be interested in the ap-

plications of the principle of leverage to sewing and washing machines, cream separators, meat grinders, carpet sweepers, etc. Those studying cabinet work, carpentry, and pattern-making, must be taught the applications of leverage to the nail puller, claw hammer, chisel, brace and bit, and foot brakers on woodworking machinery; students in stationary engineering should study the applications to safety valves, regulators, crank shafts, bell cranks and rocker arms on engines and machines. Likewise since students in plumbing use the Stilsen wrench, monkey wrench, pipe cutter, thread cutter, valves, and pumps, they should be taught the application of leverage to these tools and machines.

The opening discussion on levers for any given class must center upon the tools and machines with which the class is familiar. The large force advantage of these tools is apparent to the student and he is anxious to know how the advantage is obtained. He is therefore in a receptive mood and interested, and can grasp the great practical significance of the principle of leverage much more readily. Under these conditions the law of levers and the mathematical formulae are more than mere formalities and abstractions.

Problem work on levers must be a natural outgrowth of the opening discussion and deal with applications to those tools and machines which the student uses and is familiar with. The instructor can here exercise his originality and skill by formulating the problems so that they have a local bearing and atmosphere. Free use of the combined stereopticon and projectoscope is absolutely essential in presentations and problem work. Books and catalogs on tools, machinery, automobiles, etc., can be used in the projectoscope. The student thus sees not only the actual significance of levers in the industries, but is also enabled to trace a system of compound leverage from beginning to end. A good example of compound leverage can be studied in the steering mechanism, foot brake and emergency brake of an automobile. By projecting pictures of these lever mechanisms on the screen, and inserting dimensions for the different lever arms, a problem can be easily formulated in which the student is required to calculate the force effect on the steel brake bands produced by a given force on the emergency brake arm. In view of the great advancement of the automobile industry in the last ten years and the general interest of the public in automobiles, the value of this kind of problem is quite evident. Discussions and problems of this kind motivate the work to a great extent, and the student manifests real interest and pleasure in the subject.

Laboratory work on levers must likewise be useful and practical. It is really a final effort to impress more firmly on the student mind the principle and formulae of levers and especially their practical applications. The equipment for the laboratory study should consist of commercial types of machines and appliances in which the principle of leverage is employed. Such equipment may include a 1,000-lb. Fairbanks weighing scale, a common steelyard, a safety valve of the lever type, contractors' pumps having lever arms, full size wooden models of shoe brakes, punch rods, treadles for machines, and wrenches, tongs, shears and common tools of the lever type. Students should be required to take the equipment apart when possible, make their own measurements, calculate the leverage, resistance overcome and friction, make drawings of the lever parts, and classify the levers.

An experiment of this type consists of an examination of the levers in a 1,000-lb. Fairbanks scale. The scale is equipped with a system of levers which gives a force advantage of 100:1. That is, a 1-lb. weight on the pendant will balance 100 lbs. on the platform. The levers in such a scale are shown in

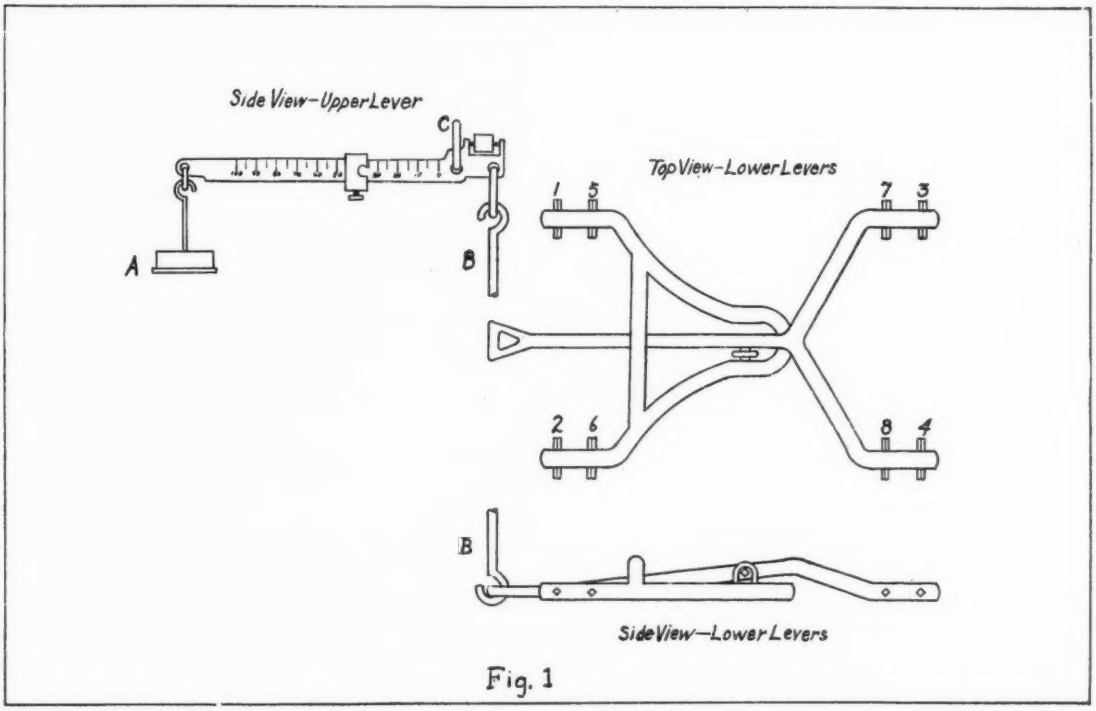


Fig. 1. Device for Teaching the Principle of Levers.

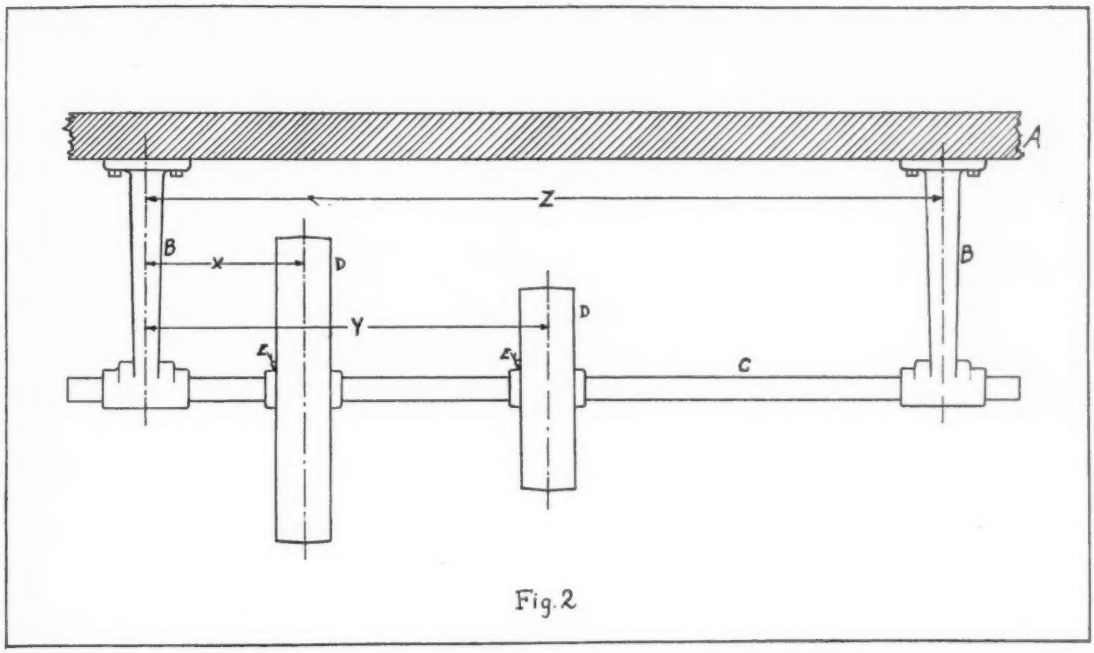


Fig. 2. Arrangement of Shafting for Teaching Theory of Movements and their Application to Machinery.

Fig. 1. Students should determine the total mechanical advantage of the levers and compare the number thus obtained with the actual ratio of 100:1. The pull on the connecting rod, B, for a 1-lb. weight on the pendant; A can likewise be calculated. A drawing of the levers should be a part of the write-up on the experiment. This drawing must have all parts lettered or numbered, and the dimensions of the lever arms can be shown or indicated on the drawing.

Again, it is futile to attempt to teach the principle of moments and parallel forces by the use of miniature apparatus in which the weight of the bar is not considered. For my work I designed and had constructed a steel bar four feet long, and one inch square, equipped with three sliding sleeves to carry weights, and a knife edge at each end. This bar can be suspended at the ends by means of spring scales attached to uprights on the demonstration table. The spring scales register up to 50 pounds and weights of from 6 to 18 pounds are used. The weight of the bar is determined before the class, it is then suspended, and weights of known amount are hung upon the sliding sleeves, after which the sleeves are tightened by means of set screws to prevent slipping. The spring scales are then read and the distance of each weight from the left end is measured accurately. Using the left end as a point of reference or pivot, the positive and negative moments are computed, from which the right end reaction is calculated. The magnitude of this reaction is then compared with the reading of the right-hand scale. As a rule the theoretical value of the reaction checks up within one-half pound of the scale reading. In the calculations the weight of the bar acting at its center, and the weight of the sleeves are taken into consideration. Using the right end as a pivot, the left reaction is likewise determined by calculation and compared with the left scale reading. As a check upon the work, the value of the right end reaction is subtracted from the sum of the downward forces, and this gives a remainder which agrees with the left end reaction. It is here that the student realizes the value of the rules: "sum of downward parallel forces equals sum of upward parallel forces," and that "sum of positive moments equals sum of negative moments."

This demonstration explains the principle of moments and parallel forces quite well, but if the subject is dropped here the demonstration fails in its purpose.

The student must be made to appreciate the useful application of this principle by following the demonstration with real problem work and practical laboratory exercises. Problems on the strength of beams and beam reactions on walls and foundations should be given to classes in architectural drafting and design; and a laboratory exercise on moments in which a 12-foot 2x4 or 2x6 is used should end up the work. In this exercise the students support the beam between two tables, weights of from 20 to 50 pounds hung at various points on the beam represent walls supported by the beam, and the end reactions are measured by just lifting each end with a large spring scale. Each spring scale reading is then checked by computing the reactions as explained above. If the student fails to take into consideration the weight of the beam, the calculated results will differ quite considerably from the actual readings of the scales; a recalculation with the weight of the beam included will give good results. Such an experiment drives home the principle of moments, proves its practical value, and shows that the weights of the various members of a structure have a direct effect upon the structure itself.

For students in machine shop practice and machine design, the theoretical work on moments should be followed up by a laboratory exercise on shaft hangers and machine bearings. Equipment for this work consists of a length of standard size steel shaft, supported at each end by hangers. Two or three shaft pulleys varying in diameter and weight are attached to the shaft at various positions. Each pulley

is equipped with a set screw, so that it can be shifted along the shaft, making it possible to take several sets of readings for the experiment. Fig. 2 represents the arrangement of the equipment. The ceiling to which the hangers are bolted is shown at A; B, B are the hangers; C is the shaft supported by the hangers; and D, D are the pulleys made adjustable along the shaft by the set screws E, E. The object of this experiment is to calculate the pressure produced on the bearing of each hanger for various positions of the pulleys. In order to obtain the necessary data for this experiment the student must remove the shaft and pulleys and weigh them separately. They are then replaced and the distances X, Y, and Z are measured. This data is sufficient for calculating the pressure produced on the right end bearing. By measuring distances from the center of the right hanger, the pressure on the left end bearing is calculated. As an additional problem in this experiment the student assumes a pull of given amount to be produced downward on one of the pulleys by a driving belt. Pressures on the bearings are then recalculated. The primary function of such an experiment is to show the pupil the useful application of the principle of moments to machinery. In addition the relation between the different parts of a line shaft and their arrangement is made apparent, and the pupil receives his first lesson in shaft alignment.

As this equipment can be used later for experiments on the transmission of motion by means of belts and pulleys, and also for a study of the coefficient of friction of machine bearings, the initial expense necessary in the installation is well worth while. A small electric motor belted to one of the shaft pulleys furnishes a means for the investigation of circular speed changes produced by a variation in the diameter of the driven or driving pulley. In the performance of this experiment the use of commercial types of speed indicators and tachometers is studied. The R. P. M. of the belted shaft pulley or shaft is first calculated from the measured R. P. M. of the motor pulley, its diameter, and the diameter of the shaft pulley. The actual R. P. M. of the shaft is then obtained by means of an ordinary circular speed counter or tachometer. Any difference between the calculated R. P. M. and actual R. P. M. of the shaft is due to slippage of the belt. By changing the size of the belted shaft pulley a second and third set of readings can be obtained. Two or three problems on shaft and pulley speeds are a fitting summary to this experiment. They are generally of the following type:

1. An engine which has a speed of 85 R. P. M. drives a 5 ft. pulley on a line shaft from a 12 ft. fly wheel. This line shaft in turn drives from a 28 in. pulley a counter-shaft with an 18 in. pulley. Find the R. P. M. of the counter-shaft.
2. It is necessary to run a counter-shaft at 310 R. P. M. If the driving pulley is 18 in. in diameter and has a speed of 175 R. P. M., what must be the diameter of the pulley on the counter-shaft?

Most textbooks deal with the subject of hoisting pulleys in a formal manner, making very little or no reference to the commercial types of hoisting machinery so much used in modern construction. This gives the pupil a poor conception of the pulley block and its principle as applied industrially. In the presentation of this subject the elementary idea should be accompanied by slides and projections of the hoisting and loading machinery employed at steel foundries, docks and factories.

Then, too, the laboratory work usually consists of the simple arrangements of single, double, and triple pulleys, usually miniature in size and of no practical significance. Pulley blocks capable of lifting several hundred pounds should be used and their efficiency determined. A differential pulley hoist of the commercial type will add to the pupil's practical appreciation of the mechanical advantage of machines.

The "Pull-U-Out" apparatus for automobiles manufactured by a St. Louis firm affords a fine laboratory problem for the advantage of pulleys and levers. This apparatus is small, compact, and not expensive, and has an enormous pulling capacity which commands the interest and attention of the pupil. The advantage of pulleys on a scaffold should be obvious, yet why not construct a small scaffold at least 10 ft. in length and let the pupil arrange the pulleys in various combinations. He will see for himself the advantages of the combinations, it will bring into play the constructive instinct, and the useful part of the experiment will not be so easily forgotten.

Some years ago in teaching the subject of expansion of metals to high school students, the lack of real interest and understanding in the laboratory exercise was very apparent. Teachers of physics are familiar with the kind of apparatus used for this purpose. Its miniature construction in the first place produces an expansion which can be measured but not seen, and in the second place its appearance bears no resemblance to anything practical. The experiment lacks impressiveness. In our laboratory we have endeavored to make this experiment both instructive and practical by designing the equipment on a larger basis with materials which are used in the construction of buildings.

Fig. 3 is a diagram of the equipment. It consists of a one-half in. iron pipe, E, and a one-inch pipe, E′, of the same material connected by means of a 180° fitting, J. These pipes are secured to the wall by means of steel straps, D, D′, which prevent the pipes from expanding to the left, and by means of straps, I, I′, which, however, permit of expansion to the right. Pipe, A, leads to the source of steam, which is available in most school buildings. Valve, B, regulates the supply of steam to pipes E and E′, and valve, K, allows any excess steam and condensation to flow into the exhaust line, L. A gauge, C, registers the pressure of the steam which fills the pipes and is also calibrated to show the corresponding temperature of the steam. The temperature to which the pipes are heated is equal to the temperature of the steam. The expansion of the pipes is measured by means of two sets of scales, G, H, and G′, H′, identical with each other. Scales H and H′, are welded to pipes E and E′, respectively, moving with them as they expand. Scales G and G′ are mounted upon a board, F, which is behind the pipes and screwed to the wall. These scales measure the linear expansion to an accuracy of 1/100 of an inch. As will be seen from the enlarged drawing, each inch on the main or stationary scale, G, is divided into tenths, and the vernier or auxiliary scale, H, is divided into ten parts, equal in length to 9 divisions (9/10 of an inch)on the scale G. The stationary scale, G, is made adjustable by means of slots and screws.

The object of this experiment is to enable the student to determine the coefficient of linear expansion of iron, to prove that the linear expansion is independent of the diameter of the pipes, and dependent upon the length and temperature to which the pipes are heated. Scales G and G′ are adjusted so that their zero marks coincide with the zero marks on scales H and H′. The distance from the inner edge of the clamps, D and D′, to the zero marks on each set

of scales is measured,—this is 15 ft., and the temperature of the room is recorded. Steam at a pressure of 25 lbs. per sq. in., having a temperature of 263° F. is admitted into the pipes. This is accomplished by opening valve B, until gauge C shows the required pressure and temperature. Outlet valve K is open partly to take care of condensed steam. As the pipes become heated by the steam the zero marks on the scales H and H′ move to the right of the zeros of the scales above. This movement is actually visible to the naked eye and amounts to over 2/10 of an in. Both sets of scales show the same expansion, which demonstrates the fact that linear expansion is independent of the diameter of the pipes. Another trial is made by determining the additional expansion produced by further heating, which is accomplished

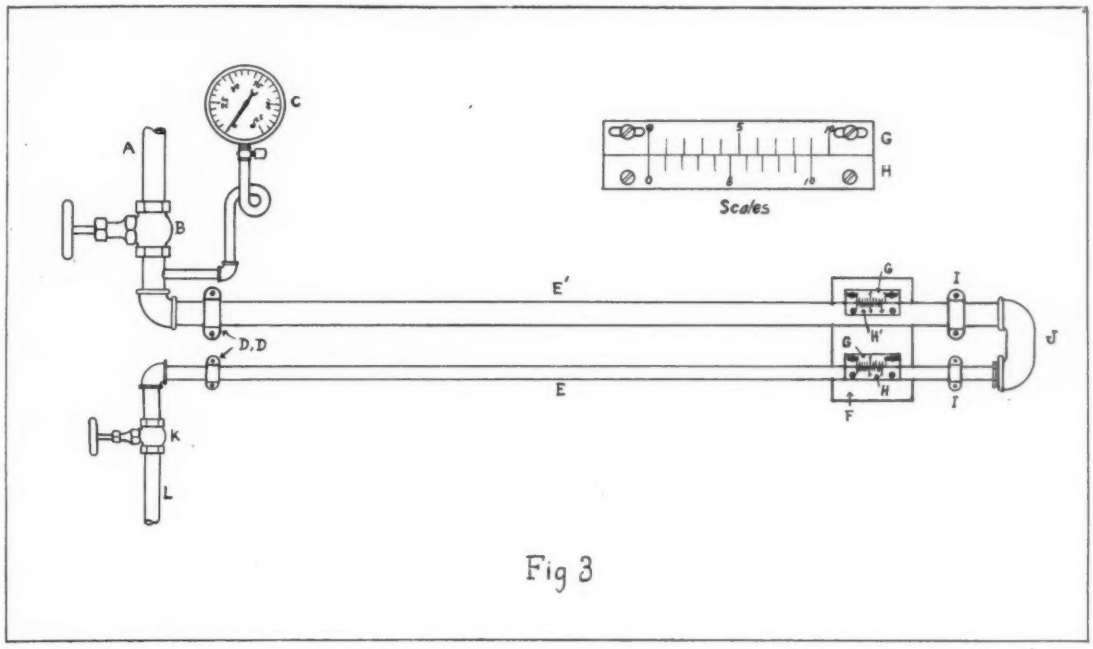


Fig. 3. Apparatus for Demonstrating Expansion Caused by Heat.

by opening valve B until the gauge indicates a pressure of 50 lbs. per sq. in. and a corresponding temperature of 298° F. The correct coefficient of linear expansion for iron for one degree F. is 0.00000599 in. An average of fifty trials with this equipment gives the figure 0.00000623.

It is readily seen that the above experiment has a two-fold advantage over the standard scientific apparatus generally used. In the first place it is constructive in design and practical in appearance, and in the second place the amount of expansion can not only be measured but can actually be seen. Incidentally, the student has before him the evidence on the face of the gauge that the temperature of steam increases with an increase in its pressure, a fact which is of great significance in steam heating plants of the factory and home, and in power plants. This experiment also demonstrates the need of loose hangers and of expansion joints in lengthy pipe lines.

Another subject which is poorly taught in the laboratory work is that of pumps. The apparatus usually consists of the well-known glass models. A pump experiment performed with such models will never command the respect of boys. Girls consider the models "dainty" and "cute." Pumps of this type are never used and never will be used in practice. Why use them at all? We use a double-acting force pump of the commercial type with a second-class lever arm about 5 ft. long, and this pump has seen service in our boiler room as well as elsewhere. It is the same type of pump as contractors use for emptying excavations after a heavy rain. With a monkey wrench the students unscrew the valve caps, remove the valves and piston, and examine the appearance of the cylinder inside. They then make a longitudinal cross-section sketch, showing the position of the vital parts. From this sketch they trace and explain the action of the two sets of valves for a complete stroke. Here the work on levers, previously given, is again brought up before the mind of the student. I am convinced that the principle of pumps is brought home very forcibly thru the medium of such an experiment, since the equipment is useful and of a commercial type. Another pump, of the kind generally used for wells, is at hand for a study of the lift pump.

In a later experiment these pumps are connected to a suction tank on the floor and a storage tank of about 30 gallons capacity situated near the ceiling. Water from a faucet runs into the suction tank, and the students pump a given amount of water into the storage tank, measuring with a spring scale the force on the end of the lever arm necessary to operate the pump. The vertical distance between suction and storage tanks is measured, and the amount of work done in pumping up the water is calculated. Likewise the efficiency of the pump is determined. Many pump problems of this class are found in physics texts, but the problems are made clearer and more concrete when worked out in the laboratory by the student himself.

The subject of water pressure can readily be studied experimentally in a practical way by means of very simple equipment. Students as a rule cannot understand the reason why the pressure of water at

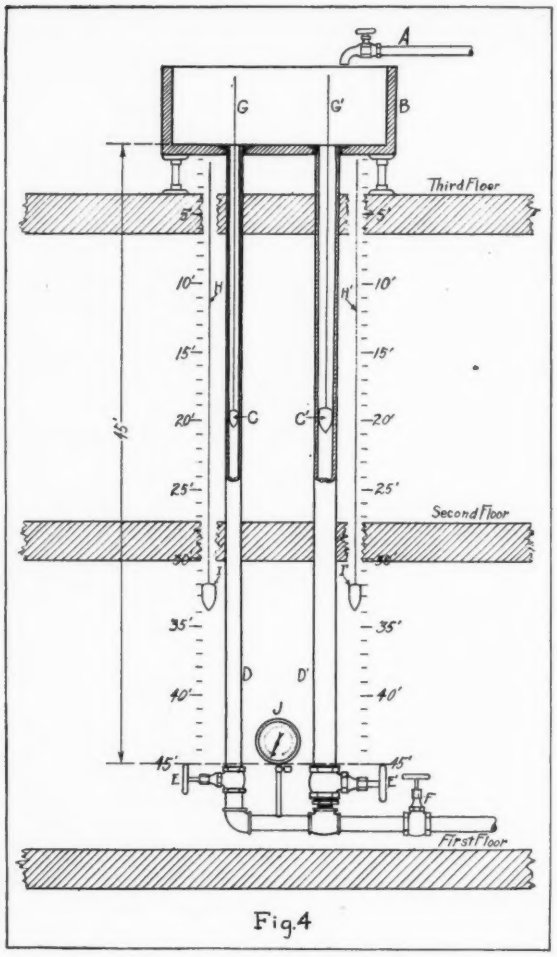


Fig. 4. Device for Illustrating Water Pressure.

the bottom of a 4 in. pipe is the same as at the bottom of a 2 in. pipe, provided the height of the water is the same. In order to demonstrate the principle that unit water pressure is independent of the cross-section area of the containing pipe and is directly dependent upon the height, we have installed the simple equipment illustrated in Fig. 4. It consists of a water tank, B, situated on the third floor, to which is connected a 2 in. water pipe, D, and a 4 in. pipe, D′, both pipes reaching down to the first floor. These pipes terminate in valves, E and E′, on the first floor and are connected together. Valve F is used to drain the tank and pipes. Two floats, C and C′, fit loosely in the pipes. Cords G and G′, which are tied to the floats, pass over pulleys and connect with cords, H and H′, terminating in height indicators, I and I′. A gauge, J, is connected between the two pipes. The vertical distance between the gauge and the bottom of the tank is 45 ft., and the height of the indicators is shown by two scales which are painted on the wall behind the indicator cords. Water from pipe, A, is allowed to flow into the tank; valves E and E′ are opened and valve F is closed. As the water enters the pipes, the floats rise slowly and the height indicators travel downward. The gauge registers the pressure of the water per sq. in., and the indicators show the corresponding height of the water in the pipes. The pressure registered by the gauge is noted for every five feet that the indicators drop, which gives a set of nine experimental values. The student is then required to calculate the pressure for each increase of five feet of water in the pipes, using the pre-determined figure, 0.434 lbs. per sq. in. per foot of height. Gauge readings are then compared with the calculated pressures, and they invariably check within experimental error.

Two rules for water pressure are explained by this practical experiment. Since the height indicators register the same height for one pressure, it is evident that pressure per unit area is independent of the cross-section area of the pipe. Also a comparison of the calculated and experimental pressures proves conclusively that the pressure is directly dependent upon the height of the water. At the conclusion of this experiment a few problems of the following type are given:

1. If the water pressure in the basement of a building is 60 lbs. per sq. in., what will be the pressure of water at a tap on the third floor, 45 ft. higher?
2. The surface of the water in a city reservoir is 30 ft. higher than the tap on the tenth floor of a sky scraper. What is the pressure of the water at this tap?

In most physics laboratories, especially in the secondary schools, very little theory on the steam and gasoline engine, and much less laboratory work is taken up. Most of the instruction is conducted from pictures, diagrams and models. Usually these models are too small for practical purposes. Considering that the steam and gasoline engines have revolutionized industries and transporation, it is essential that thoro instruction about these engines constitute a part of the course in mechanics of heat. A study of this subject can be vitalized and motivated by laboratory equipment consisting of a steam engine of several horse power connected to the steam supply of the school, and a 4-cyle, 4-cylinder automobile engine with its accessories, so that actual horse-power tests can be made.

Many practical experiments can be performed with the steam engine. By removing the face plate of the steam chest, the slide valve is exposed to view, and its action can be studied by slowly revolving the fly wheel by hand. With the slide valve, steam ports and exhaust port exposed, it can readily be seen that steam enters the crank end of the cylinder at the beginning of the head end stroke, that the steam supply is cut off at about one-third of the stroke; that almost the entire remainder of the stroke is completed by the expansive force of the steam; that the exhaust pipe is open to the crank end of the cylinder slightly earlier than the end of the stroke; that the expanded steam is forced into the exhaust line during about four-fifths of the return stroke; and, that during the remainder of the return stroke, since both intake and exhaust ports are closed, the residue of steam in the crank end of the cylinder is compressed. If the engine is double-acting, the same cycle of changes is taking place in the head end of the cylinder, but in reversed order. At this point of the instruction the student draws a theoretical indicator diagram or card to show the steam pressure changes which take place on one side of the piston for one complete stroke. Later an indicator card is taken with a steam engine indicator connected to the cylinder of the engine. The average pressure of the steam for a complete stroke is then calculated by dividing the area of the indicator diagram by its length, and multiplying by the pressure which each inch of height represents. From the average pressure, area of piston, length of stroke, and number of strokes

per minute, the I. H. P. is easily calculated. If a brake horse-power test is made on the engine at the same time that the indicator card is made by the indicator, the per cent efficiency of the engine is readily determined.

The steam engine indicator can also be used to determine whether the valve of the engine is properly set. The shape of the card drawn by the indicator shows immediately whether or not the valve is properly set to obtain maximum efficiency out of the steam. If the indicator card has a steam line that is too long, this shows the steam cut-off is too late, which means a waste of steam and a loss of power due to the incomplete expansion of the steam. The valve of the engine can be set incorrectly by the instructor, and this furnishes a splendid laboratory problem on steam valve setting. By the aid of the steam engine indicator successive cards can be taken for various positions of the valve, until the proper lead and lap is shown. When this is accomplished the valve is considered properly set for greatest efficiency.

Also, with the face plate of the steam chest removed, the action of the centrifugal or inertia governor in regulating the steam supply in proportion to the load can be clearly demonstrated.

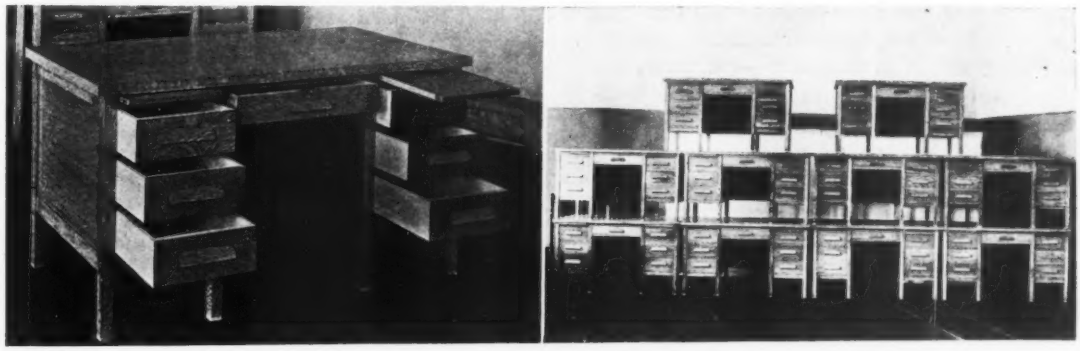
Experiments on the gasoline engine can be made just as interesting and instructive. A student obtains the best conception of the relation, function, and operation of the various parts of a gasoline engine if he is allowed to take it apart. If the cylinder head or entire cylinder is unbolted and removed, the piston, piston rings, wrist pin, and connecting rod can be examined. By removing the end plate or side plate of the crank case, a study of the crank, crank shaft, and main bearings is readily accomplished. The operation of the valve mechanism is made clear by exposing to view the main shaft gear, the cam shaft gear, the cam shaft, cams, and push rods. After the relation and operation of the main parts and accessories is made clear, the engine is reassembled, a carburetor is attached, batteries and a secondary coil are connected to the engine, and horse power tests are made. The efficiency of the engine is determined by measuring the quantity of gasoline consumed in a given period of time, during which a load is applied to the engine by means of a proxy brake. From the data obtained by the brake test, the D. H. P. is calculated. The amount of energy in-put is calculated from the quantity of gasoline consumed and its heat value previously determined by a Parr calorimeter.

$$\text{H. P. (In-put)} = \frac{\text{Pounds Gasoline Consumed} \times \text{Heat Value} \times 778}{550 \times \text{Time in Sec.}}$$

Many more subjects from the mechanics of solids, fluids and heat could be profitably taken up, and it is with reluctance that I close the discussion here. Thru the zeal with which I have tried to emphasize my main points I have no doubt presented the topics in an irregular order, but a complete discussion of the subject of mechanics requires more time and space than can be allotted to this paper.

In conclusion it should be stated that no criticism can be made of the selection of subjects in mechanics which are taught in secondary schools. But the method of presentation and the type of laboratory work generally performed must ultimately be motivated and made practical, in order that the study of mechanics be a real contribution to the vocational idea and to industrial schools.

Lately, the gigantic demands of the present war upon the industrial and technical army of our country have demonstrated most vividly the woeful need of men equipped with knowledge of the industries and sciences. Schools are being organized to instruct not only in the pure shop work of vocations, but also in supplementary studies, such as applied science, drafting and mathematics. It is for these schools that the subjects of applied science must be reorganized and re-presented, with the idea of usefulness the dominating one. As this idea is both logical and pedagogical, there is no reason why it should not be extended to the study of mathematics, English, history, etc. Any school organization in which the course of study is motivated by the useful idea is discharging more efficiently its task of educating the children of this country for the commercial and industrial world into which they must ultimately adjust themselves.



TEACHERS' DESKS MADE BY STUDENTS.

The desks illustrated above were made by the first and second year shop classes of the Northern Normal and Industrial School at Aberdeen, S. D., as a "factory" project. The desks which are in use by the teachers of the institution are 30 inches high and measure 30 by 54 inches. Mr. H. P. Gerber was the instructor in charge.

A PLEA FOR CLOSER CORRELATION BETWEEN THE FINE ARTS DEPARTMENT AND THE INDUSTRIAL ARTS DEPARTMENT IN OUR PUBLIC SCHOOLS[1]

Clara Torrey Clement

I. Present Situation, Its Needs.

HALF a century ago, when art was enjoyed by only a privileged few, when beauty had but little place in the life of the masses, Emerson foretold that "Beauty must come back to the useful arts, and the distinction between the fine and the useful arts be forgotten."[2] The twentieth century is seeing the fulfillment of the prophecy, for tho we, as a nation, have been engrossed in the organization and development of our resources and industries, we are now awakening to the importance of raising our artistic standards. Our educators are talking about the value of the industrial art schools abroad, where, in many cases, the government provides practical artistic training in connection with the industries. "The lack of any plan to train the tastes of our talented boys and girls is what causes us to ship raw material, such as wheat and iron ore, to France, in order to pay an annual bill of $100,000,000 for the clothing models she sends us, the value of which lies in the initiative and the esthetic touch the French designers and workers have given them."[3]

Mr. Royal B. Farnum, State Inspector of Drawing for New York State, emphasizes the relation of the art products to the economic condition of the United States in his annual report for 1916. A summary of his statement is as follows: A nation passes thru three stages of economic development. The first is characterized by the weakness of the infancy of the country, when it depends on sustenance from outside sources, with a wholly importing commerce. In the second stage the nation exports raw material, and imports to as large extent as in the first stage with this difference, however, that it buys back its own raw material in a perfected stage. In the third stage it is able to manufacture its own raw materials, it exports only a surplus, and imports only those goods which cannot be so readily procured at home. Mr. Farnum feels that the time has come for us to enter upon this third stage but that we must raise the artistic standard of our products in order that we may successfully compete with foreign made articles. He shares the widely accepted opinion that the first steps toward making this nation productive of the highest type of goods, as well as creating a higher sense of appreciation, must be taken in the public schools.[4]

It is the effort of this thesis to prove that closer co-operation between the fine arts and the industrial arts departments of our schools will aid perceptibly in bringing about the desired ends, first, more valuable and artistic products; second, more developed powers of appreciation, and therefore better standards of taste for the community.

II. Closer Correlation Will Increase the Efficiency of the Producer.

An editorial in the School Arts Magazine of January, 1917, made the interesting statement that the Standard Oil Company, recognizing that a knowledge of the prominent art principles causes higher efficiency in their employees, requested instruction for them in lessons that would develop working knowledge of mechanical drawing and design as well as appreciation. It is questionable, however, whether such training without specific application to the work of these employees would be of any practical value. The experience of art teachers confirms the pedagogical hypothesis that principles of form and color can never become a useful part of the student's mental equipment until they are applied.

Kant stated a profound and many sided truth when he said that notions without perceptions are blind, that they are empty forms. The man whose whole knowledge consists of abstractions has indeed an empty mind. He is able to deal in nothing but glittering generalities, so that his thinking pertains but slightly to the practical affairs of the world. If knowledge is to have full, rich content, as well as universality, the general truth gained must be perpetually enriched and reinforced by application to new particulars. This wide and persistent application of general truths is essential to their becoming a permanent acquisition to the child. A principle in arithmetic, for example, even tho fairly grasped by the pupil, will soon fade from his mind if extended application has not impressed it there. In the same way the general principles of art taught in the fine arts department will be greatly reinforced and made permanent if definite application of these principles can be made in the industrial arts department.

It is here that the value of co-operation between the fine arts department and the industrial arts department is first seen. From the primary grades upward every art lesson can be applied to one or more of the handicrafts. It is the teacher's province to make this application apparent to the pupil. The question is immediately suggested, "What possible connection can there be between sketching from the still life group and a problem in basketry?" The answer lies in the fact that all art is governed by the same principles. If a student can see that the same laws of space, tone and color govern the arrangement of the still life objects that govern the

1 A thesis presented to the New York State College for Teachers May, 1917, in partial fulfillment of the requirements for the degree of Master of Arts.

2 Emerson's Complete Works, Concord Edition, vol. IV, p. 367.

3 Prang's Art Education for High Schools, 1915.

4 Annual Report of Royal B. Farnum, 1916.

shape and pattern of a basket or the design of a well made table, he will have made those laws his tools, with which he can work out intelligently and independently any problem in his own line of industry. But if he learns in his art classes how to apply these principles only to the decoration of an Easter card or a port-folio cover, in all probability he will never use them in later life, for they will have long been meaningless terms.

Interest of the pupils will be stimulated if a definite application to something practical follows each step of design.

This needs real co-operation between the drawing and the industrial arts teachers, for a pattern designed in the art department for an object to be turned out in the wood shop loses all practical value unless the requirements and limitations of the material used are taken into consideration. Thus, designs made in the fine arts department might be sent to the proper industrial arts department for corrections, then returned for completion to the department that planned them. This method was followed in the New York State College for Teachers, where designs for wooden candle-sticks were made in the drawing class. These drawings were then criticised by the instructor in the woodworking shop and returned to the drawing class for corrections and tracings before work on the candle-sticks in the wood shop was undertaken. The results were highly satisfactory both to the two instructors, and to the pupils themselves. This kind of co-operation between the instructors prevents the execution of unworkable drawings, and interests the pupils in the careful consideration of the detail of construction.

"It is too much the tendency of the schools to impart knowledge in parallel lines having little or no vital connection." Drawing, manual training, millinery, handwork, are usually taught as separate and unrelated branches of learning. "When related studies are taught this way there must necessarily be great waste in the labor of learning, and great deficiency in the ready use of what is learned. The perpetual return from the general to the particular is the most effective means for the co-ordination of knowledge. To a greater or less degree, all knowledge is related, all wisdom has a bearing upon every great enterprise of life."[5] Why not, then, make clear to the pupil, who in the public schools must have at least seven or eight years of art work, that these often tiresome and meaningless exercises count directly toward the results of his work in manual training, handwork, or millinery, and just as directly toward the standard of artistic values he is setting for himself.

For the industrial art department this closer relation with the fine arts department would bring about more artistic results than are at present attained. Teachers of the crafts and industries cannot be expected to have had even the art training that is now offered in our high schools, to say nothing of the specialized study of design, which has been the preparation of the art teacher for his work. The importance of good design to the crafts and industries cannot be over estimated. Otherwise the European countries which are foremost in artistic productions would not support in large numbers the industrial art schools referred to on page one.[6]

Drawing has always been considered the universal means of expression. If the dependence of the completed industrial product upon the design were fully recognized, industrial art would offer an equal opportunity for self-expression. The value of art study lies first in acquainting the pupil with the best that has been done in the field of art; second, in the appreciation of the best that comes only after the effort to create has been made by the individual, and third, in the joy of creating, or of expressing in a measure his ideals. Correlation of these two departments would first bring the student into contact with the highest type of his special kind of industrial work, and then by approaching his problem from the design viewpoint, he would feel the creative joy that is only partially supplied when he builds his table, or when she fashions her hat from ready made patterns. The satisfaction in the piece of handwork that is, from the very beginning, the pupil's own creation, is without parallel. We, as a nation, are so preeminently practical that the element of play can be introduced into our vocations with little danger of our demoralization. Moreover, what our products need is the original touch that gives the imported goods so much higher artistic value.

III. Correlation Will Increase the Power of Appreciation.

The psychologist joins the pedagog in upholding the theory that a well developed race must have an artistic sense, and that the more highly developed that sense of appreciation becomes, the more satisfaction will there be in life. The psychologist and the pedagog agree that there are two aims of education. First, to acquire scientific knowledge, i. e., practical mastery of the world for outer achievements. Second, to gain that esthetic sense which brings enjoyment. Scientific knowledge gives data in connection with results, and causes, and relations. The scientific description and explanation of the thing does not bring us nearer to the reality of the thing itself, but leads us away to the other objects with which it is connected. Esthetic knowledge gives us the truth about the object isolated from all practical considerations. "To find satisfaction in the isolated object is to know that repose which a mere restless striving for practical ends promises, but never gives."[7] Art instruction can train this power. But only that art instruction which teaches why certain forms and combinations are good, which is broad enough to

5 De Garmo's Aesthetic Education. C. W. Bardeen, Syracuse, 1913.

6 Snedden's Problems of Art Education. Report of the Annual Meeting of Eastern Art and Manual Training Association, 1916.

7 Munsterberg's Principles of Art Education. Prang Company, 1915.

apply to all phases of every-day life. This breadth of application can be gained only by stimulating pupils to think for themselves, and to discriminate between the fine and the mediocre in every instance. Mere imitation of good design only creates a tendency to follow blindly the dictates of style.

[8]"The development of an appreciation of art, the creating of intelligent consumers seems to me the most important function of our art department. Whether we are to be a people with rising standards of taste in the selection of commodities and comforts, as well as with high ideals in the fine arts, is dependent upon the extent to which the school system develops in the children that are coming up thru these schools, a taste that will enable them to set better standards in material and workmanship. Impressed by the crying need of a more artistic product from our shops and factories one is likely to run to the conclusion that our deliverance lies in developing the creative ability of all our boys and girls who go into the industries either as leaders or productive workers. This may have been true a century ago, when under the simple conditions of life the old artisan trades were followed by well rounded workmen, each of whom had a chance to put his own individuality and his sense of beauty into the things he made. Modern industry is not so organized. It is probably safe to say that under the conditions that surround the workers of today few of them have a chance to exercise ingenuity and individuality in the making of things, save those who are employed as designers in the office of the concern making blueprints which the workers are obliged to follow carefully."

By way of emphasizing the relative importance of teaching art for the sake of production and art for the sake of appreciation, Mr. Prosser gives elaborate statistics which have been summarized as follows:

10,000,000	persons in the United States in the distributive callings, i. e., lawyers, teachers, clerks, stenographers, who need training in the appreciation of art, but none of whom can find the slightest use for art training for production's sake.
30,000,000	persons in the productive callings, of these
14,000,000	are employed in agriculture.
1,000,000	are employed in mining.
4,000,000	are employed in domestic service.
8,000,000	are employed unskilled industrial workers
27,000,000	productive workers, who, like those in the distributive calling, have no chance to use any ability to create what they may possess.
3,000,000	skilled productive workers, i. e., carpenters, pattern makers, designers. Even here the substitution of machine for hand labor has deprived the majority of these workers of any opportunity to make and execute their own designs.

It would not be stretching the imagination to say that out of the 40,000,000 (10,000,000 in the distributive callings, 30,000,000 in the productive callings) engaged in gainful occupations less than one million have any opportunity to put their own individuality into the things they produce.

We do not have to look far to find corroboration for Mr. Prosser's statement of the importance of developing in our schools more intelligent consumers. A trip thru the furniture, drapery, and wall paper departments of the furnishing houses, a glance at their window displays, testify to the fact that what appeals to popular taste is imitation of something expensive, poor ornamentation, rather than simplicity and good proportion. Consider the window display of furniture, for example; the requisite seems to be highly polished wood, stained to look like mahogany or oak, with upholstery of a shade that screams for recognition, and lines that cannot possibly suggest comfort. If the public at large wanted it we would soon be able to make here in America furniture combining good color, line and proportion. The number of people whose taste demands the more refined imported productions is slight compared to the mass who are satisfied with the mediocre goods of our own manufacture.

John Wanamaker, in his New York store, has instituted a department in which to mold public taste to a better appreciation of both cash and artistic values. In this department are sold $20 garments that are not imitations of $120 garments, but while conforming entirely to the demands of fashion, these $20 dresses represent the very best materials that can be put together and sold for that price. No imitation lace or fur or flimsy quality of expensive material is used.

In the vocational departments of some of our high schools many boys and girls are undoubtedly having their only opportunity of seeing what may be considered high standards of house furnishing and clothing, so in this task of creating better taste, and of making more intelligent consumers, we cannot but realize the importance of giving these boys and girls the very best from both the economic and artistic points of view.

It is an accepted fact that only by hearing constantly good music can a taste for this kind be acquired. The average man who does not care for what he calls "the classical stuff" prefers the marked swing and jingle of rag-time because his ear cannot detect more subtle rhythm and melody. If during his developing and formative period he had listened to the music of the best composers he could then have learned to hear harmonies to which he is now absolutely deaf. The refinements of tone and measure would have then stirred a responsive chord, and the socalled popular music would fail to satisfy. Many

[8] Prang's Art Education for High Schools, 1915.

men and some women honestly believe that a taste for classic music is an affectation. They cannot grasp the fact that there are more delicate shades of perception than the senses which they themselves entertain. It is all a matter of contact.

In the same way appreciation for the best in literature, which is the aim of our English courses, comes only from reading good books. The boy who has been thrilled by Treasure Island, and similar good books of adventure, will always demand real heroes, and will be bored by the sentimental characters and the sequences of artificial situations of sensational cheap fiction. Early acquaintance with the philosophy and wit of Stevenson will develop a taste that cannot be satisfied with the triviality and the haphazard style of magazine stories and best sellers. Again a matter of contact.

Can the same parallel be drawn with the work of our fine and industrial arts departments? Are boys and girls more artistic in their tastes after taking courses in these departments as they stand today? Are they better producers, and above all, are they more intelligent consumers? Mr. F. A. Parsons says, "Only as we teach, train, cultivate, and nurture this idea of fitness and beauty in *everything* will it be possible to produce a race that has in it the art sense. The art sense is essential to man's happiness, and his efficiency in all social and economic life. It is not enough to teach reading, writing and arithmetic."[9]

9 Parson's Principles of Advertising Arrangement. Prang Company, 1914.

(To be Concluded in June)

CABINET WORK AT THE CLARK SCHOOL FOR DEAF, NORTHAMPTON, MASS.

F. A. Adams, Instructor

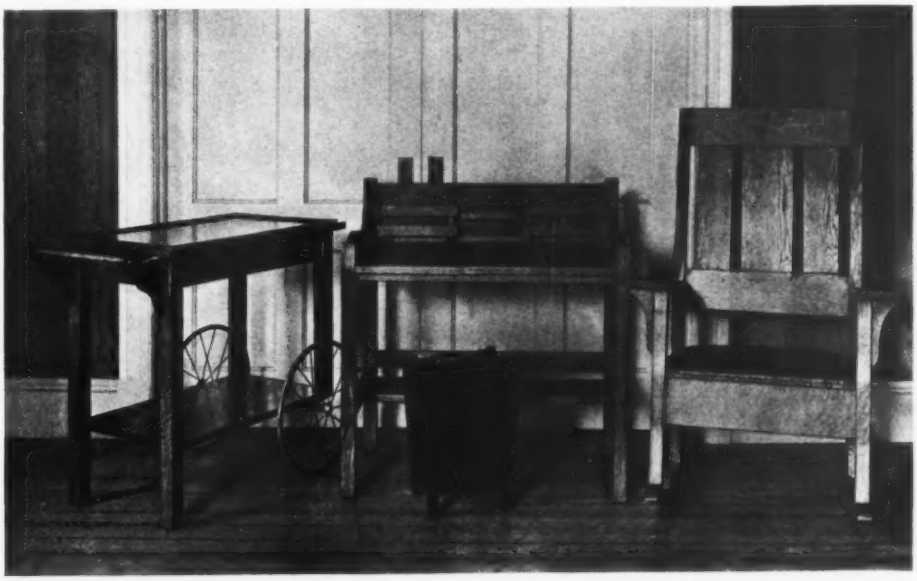
IF I should adhere to the strict meaning of the word Cabinet Making, it would not include any other kind of wood work but the construction of cabinets, but I am taking the liberty of applying this term to our work which includes not only the making of cabinets, but the designing and constructing of many types of furniture as well.

Altho our boys are handicapped to a certain extent by being deaf, they have such a thoro training in lip reading and speech that it puts them on very nearly the same level as hearing boys, at least so far as instruction in their shopwork is concerned.

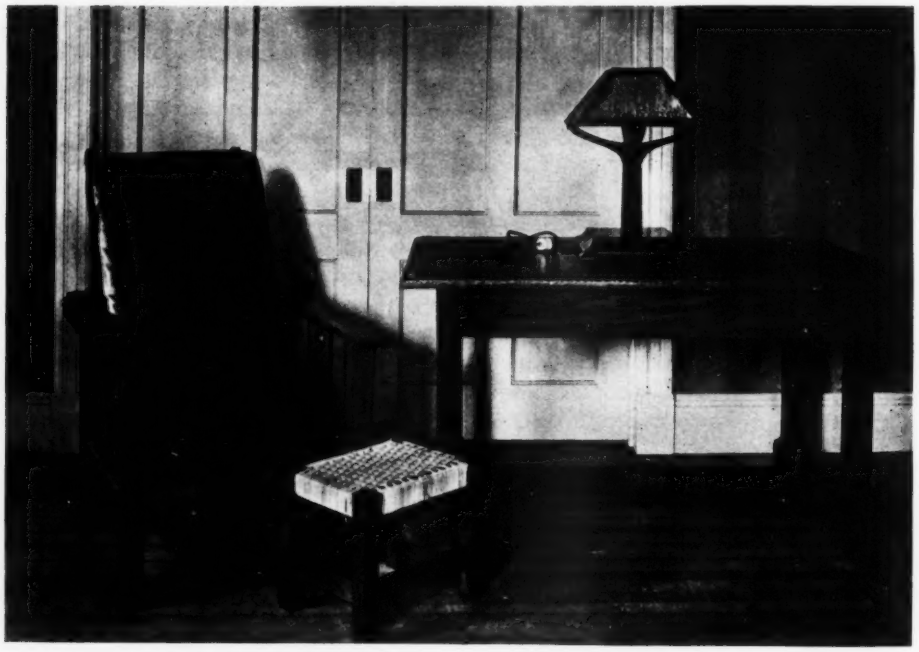
When a pupil graduates from this school he has completed the full equivalent of grammar school work. Some boys are slightly older than the average grammar school boy, but they are doing the regular grammar grade work.

Before entering the cabinet shop, the boys have an elementary training of from two to four years. This teaches them the names and uses of the average tools and also some simple constructions.

When a boy first enters the shop he goes into class II. Pupils in this class begin with the simplest possible work in furniture making, such as foot stools with reed tops, simple book cases or magazine racks, small stands, pedestals, handkerchief boxes, picture frames, bird houses, etc. Here we introduce such joints as the mortise and tenon, dowel, dado and mitre.



HOUSEHOLD FURNITURE MADE IN THE CABINET WORK CLASSES OF THE CLARK SCHOOL.



LIBRARY FURNITURE MADE BY THE AUTHOR'S STUDENTS.

The work is all individual with class demonstrations on all new joints and methods of construction.

When a new piece of work is started, the pupil fills out a card upon which he keeps a record of all lumber used, also the date of starting and the time spent upon that object during each lesson. When the object is completed he figures the number of square feet of lumber, the cost, also the total number of hours spent in making the object.

As soon as the quality of a boy's work will permit, he enters class number I. In this class he begins working upon larger pieces of furniture, such as library tables, desks, morris chairs, rocking chairs, bureaus, wardrobes, chests, lamps, tea wagons, etc. If a piece of work is made which requires simple upholstering, take for example a rocking chair, instruction in this branch is given to the boy doing the work.

A course in wood carving is offered and frequently this is combined with the cabinet work, giving very pleasing results. The past year, for instance, one boy made a mahogany desk after the Louis XV pattern and carved an appropriate design upon the lid.

In class I less time is taken for instruction in the making of joints, and more time is given to design and to discussing methods of construction. Under design, it might be mentioned here that a satisfactory working drawing must be made before any object is begun. At this time the boys are shown cuts of well designed pieces of furniture and occasionally of poorly designed pieces, in order that they may learn to distinguish between the good and the bad.

When a problem arises in construction, as for instance, the making of a paneled door or a drawer, it is used as a subject for class discussion. Careful instruction is given to prevent work from being spoiled by the shrinking, swelling, or warping of wood. At the end of the year, if a boy desires, he may have the finished product on paying for the material.

Boys who do not advance as rapidly as they should are given additional shopwork and by varying this work we try to arouse their interest and at the same time improve their workmanship. In this latter class we have taken up the designing and making of cement flower pots, setting glass, general repair work around the shop, and we have also made a number of cabinets and back rests for a local hospital. We have really found that boys who have not succeeded so well in their school work as they should, have improved a great deal since a broader course in shopwork has been offered them. This seems to be the best avenue of approach by which they may be reached, not only in their cabinet work but in their academic work as well. A card record of each boy's progress is filed each week.

LUMBER RECORD

Name_____ Object_____

Date Started_____ No. of Hrs._____

No. Pcs.	Size	Kind of Wood	No. Sq. ft.	Cost	Remarks

Record Form for Charging Lumber to Student.

In general, our aim has not been to make full fledged cabinet makers of our boys. In the first place, we have not had the facilities and in the second place we have not devoted the necessary time to the work that would be required to give a boy sufficient training to enter the ranks as a practical and experienced workman. However, some of our former pupils are following this line of work, or others closely connected with it, and are making good. In connection with this, I should add that we are gradually introducing the machinery used by the factories and we hope soon to broaden our courses and devote more time to machine work.

Our aim has been to give the boys training that will give them a good knowledge of the tools and material they are working with, to teach them to distinguish between the good and the bad, both in the unfinished as well as the finished product, to furnish them with ideas of what is to be expected of them should they desire to follow this work, to teach them to work and to take instructions from someone who is at their head, thereby gaining an appreciation of labor in general, to make them realize the value of time, and lastly to equip them with a training that will help them to better meet and solve the problems of life.

CABINET SHOP

Report for week ending .....

Workmanship.	
Drawing.	
Deportment.	

F A ADAMS Instructor

Form for Weekly Record of Students' Progress in School Shops.

The Heliograph as an Answer to Several Problems

D. D. Gurnee, Field Inspector, Military Training Commission, New York State

WHILE most of us agree that "the boys of today do not play in as businesslike a manner as we did," there is, nevertheless, to be found, here and there, a boy whose red blood shows itself in the play he chooses and in the thoroness with which he carries it out.

To set such boys a task in the making of something dignified, yet usable in their play, was the writer's bug-bear problem until the chance remark, "heliograph," by an acquaintance, in no sense a school man, started me on the best wood working job I have yet discovered for use in a school which, tho not industrial, demands that whatever is done be done in a workmanlike manner.

The job in question was presented to seventh-grade boys who had had a half year of woodwork; many of them were "Scouts," so I naturally expected the rather hearty acceptance the problem received. I did not, however, anticipate any such degree of pride and satisfaction as was manifested when the heliographs were completed and tried out. A good share of their satisfaction undoubtedly was due to the fact that, unlike many heliographs, their instrument was a "one man" device.

While the accompanying drawings and pictures illustrate the instrument and its use, a few words regarding its construction may not be untimely. As stated above the builders were seventh-grade boys, hence they knew about as much about reading a complicated orthographic drawing as they knew about Greek. Believing, however, that the use of an orthographic drawing was essential, I presented the problem as shown in the drawing. The result was highly satisfactory. If a boy became puzzled over a detail, a few minutes spent in studying the part bearing the same number in the oblique drawing would usually suffice to clear up the most hazy point.

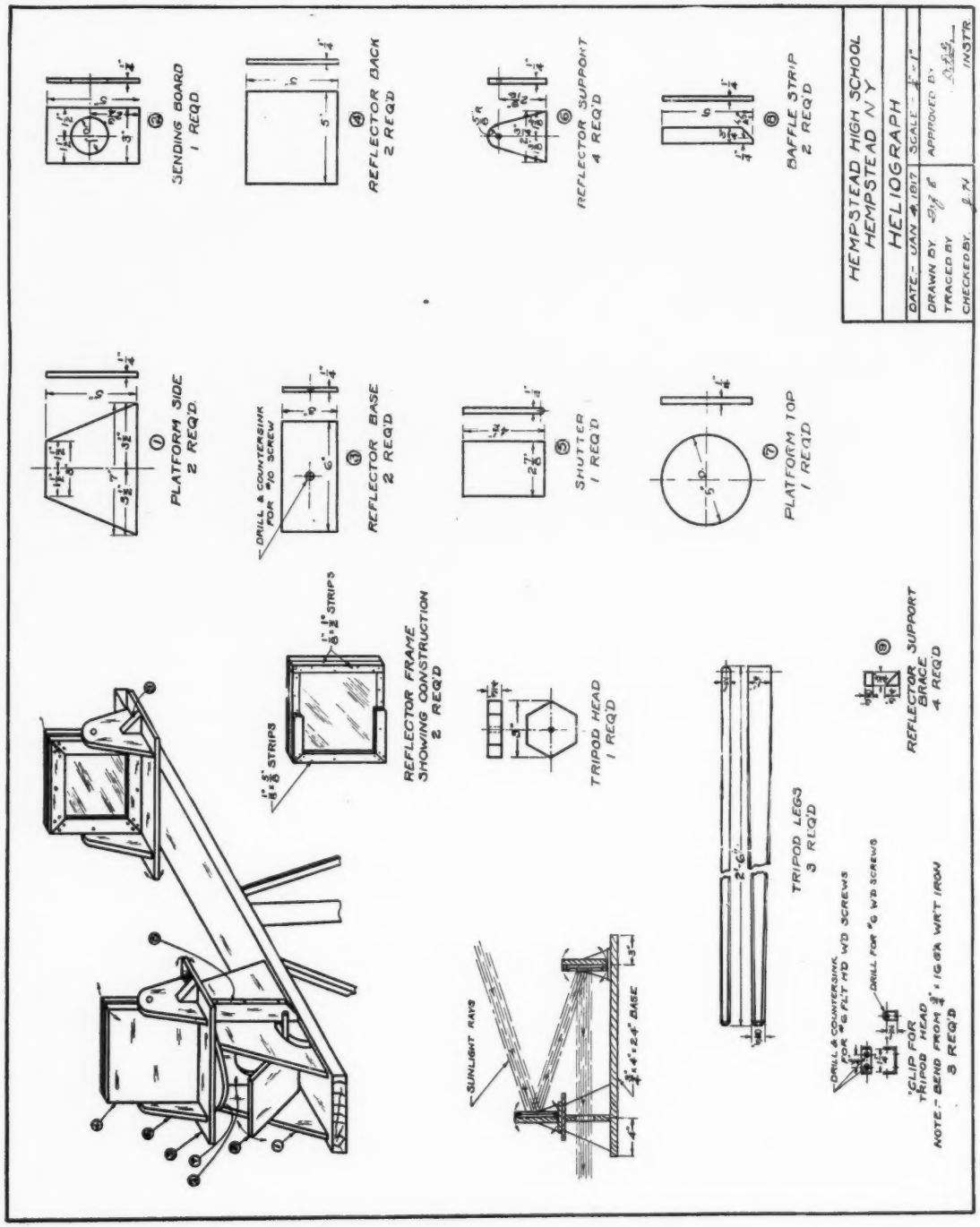
With the exception of the mirror-frame corner joints, all the joints are butted; a most simple construction, to be sure, until one considers that several of the members are movable, which fact makes necessary rather unusual care, as accuracy and rigidity are essential in order that the instrument function properly.

It will be noticed that the shutter-operating mechanism is not detailed, despite the fact that it is indicated in the picture drawing. The reason for this omission was the desire to discover the inventive ability of the boys.

Plenty of opportunities are afforded to bring out the value of center lines, a point not to be overlooked.

Aside from its worth from the standpoints of

Boy Scouts Using Heliograph Made in School Shop.


HEMPSTEAD HIGH SCHOOL
HEMPSTEAD N Y
HELIOGRAPH
DATE - JAN 4 1917
SCALE
DRAWN BY
TRACED BY
CHECKED BY
APPROVED BY
INSTR
① PLATFORM SIDE 2 REQ'D
② SENDING BOARD 1 REQ'D
③ REFLECTOR BASE 2 REQ'D
④ REFLECTOR BACK 2 REQ'D
⑤ SHUTTER 1 REQ'D
⑥ REFLECTOR SUPPORT 4 REQ'D
⑦ PLATFORM TOP 1 REQ'D
⑧ BAFFLE STRIP 2 REQ'D
DRILL & COUNTERSINK FOR #10 SCREW
1" x 8" STRIPS
1" x 1" STRIPS
REFLECTOR FRAME SHOWING CONSTRUCTION 2 REQ'D
TRIPOD HEAD 1 REQ'D
TRIPOD LEGS 3 REQ'D
REFLECTOR SUPPORT BRACE 4 REQ'D
SUNLIGHT RAYS
DRILL & COUNTERSINK FOR #6 FLT HD WD SCREWS
DRILL FOR #6 WD SCREWS
SLIP FOR TRIPOD HEAD
NOTE - BEND FROM 3/4" x 16 GA WRT IRON 3 REQ'D

DETAILS OF HELIOGRAPH.

education, usability and play, the heliograph is a direct response to the nation-wide appeal to teachers to make their work count toward a constructive and sustaining, as well as defensive, military preparedness.

SOME PINE NEEDLE BASKETS MADE BY THE AUTHOR'S CLASSES.

PINE NEEDLE CRAFT

Mabel R. Stauffer, Supervisor of Art, Pottstown, Pa.

WITH natural round reed at a price far beyond the reach of most schools it became necessary last year for our dealers to look around for some substitute. Several of them offered "Florida pine needles." A prominent western firm was kind enough to send me a sample package and I was seized by a desire to try them out. With the aid of their directions and a small basket that a friend had brought from Florida I ventured to see what I could do. After making a basket successfully I planned several more and presented them to my grade teachers. They looked upon the baskets rather dubiously at first, but to give the new material a fair trial we started it in six rooms of about forty children each of the seventh and eighth grades. With the loyal support of the grade teachers we made a great success of it. In two months' time we had about four hundred baskets. These pupils had not had any supervised training in drawing or manual work until their seventh year in school, and therefore had no skill in handling the materials when they started.

The grade teachers liked the pine needles-and-raffia better than any previous material because it was much easier to handle. It did not require much soaking, differing from the natural reed, which had to be used wet. The material was easily distributed, as an equal amount could be left upon each desk and was easily kept in order. The progress was more rapid with the binding of the pine needles together than in making the raffia and reed baskets.

As the pine needles are about twelve inches long the strand has to be renewed often. This seemed to be a disadvantage at first, but the pupils soon learned to "pull the ends" and place the new strands so that the splicing was invisible.

The pine needle craft appeals to me as a real American craft employing an entirely native product. The pine needles might grow in our own localities and one could easily gather and dry them for oneself. We found small pine cones growing near and gathered them to use as a decoration for our handles. There is great opportunity for originality in designing the forms. The combining of the colored raffia with the pine needles is a problem in harmony of color and the arrangement of the stitches, and solid rows offer an opportunity for the division of the space by tones and lines.

In each grade we used 24 half-pound packages of pine needles, three pounds of the natural raffia and two pounds each of the three colors, green, garnet, and brown, one pound of No. 5 or 6 natural round reed for handles and fifty tapestry needles. Pupils furnished round and oval wooden bases made of cigar boxes when they were needed. Almost every pupil had two baskets, one small one as a first product

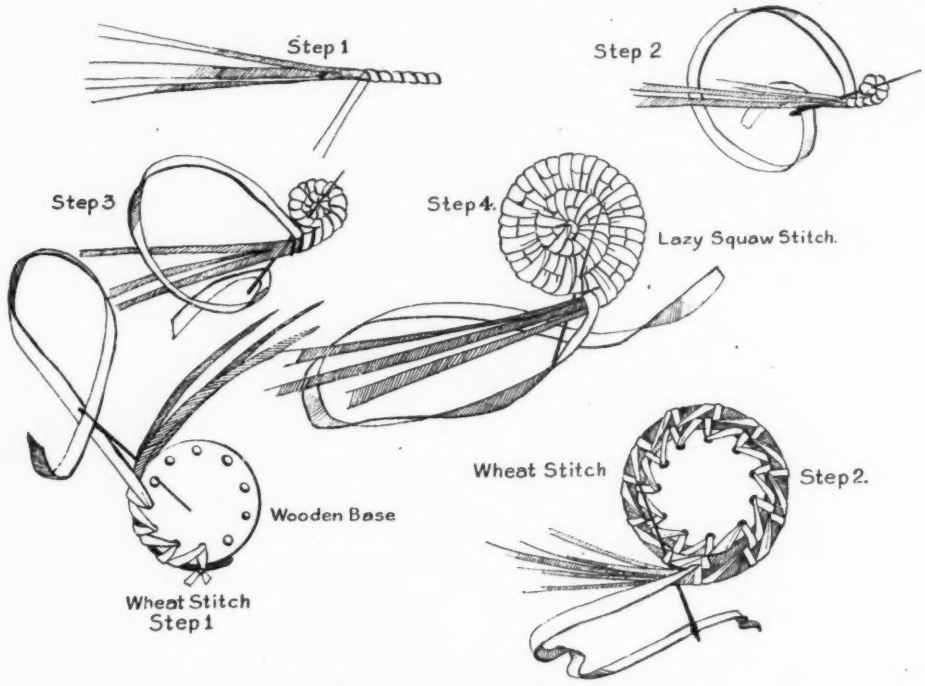
and a large sandwich basket, tray or sewing basket as the second product. For the first basket I found it advisable to use a round wooden bottom, two inches in diameter, with about ten holes along its circumference one-quarter of an inch from the edge. With the wooden base the pupils learn the stitch without a handicap.

It is necessary to soak the pine needles for an hour or two for the start, as they are brittle and will break while being coiled into a small circumference. After the basket gets well along it is not necessary to soak them. The raffia must be used wet to make the work firm and tight. While wet it stretches a certain amount, leaving it very tight when dry. It must also be split and great care must be taken to always use pieces of uniform width, otherwise the work will not look even. A narrow piece is preferred for starting the center. After a few rows wider strands may gradually be used.

The stitch used has several names, probably best known as "the wheat," as it resembles one side of a wheat head. It has one long stitch produced by carrying the raffia from one row to the next, and has one short stitch made by binding two rows of pine needles together.

To start a basket with the wooden bottom, tie a strand of raffia thru one of the holes in the wood, place a strand of three-leaf pine needles against the edge and work at the bottom, going from the right to the left side. Sew thru the hole once, bringing the needle out on top. Carry the raffia from the top of the wood to the bottom and up thru the next hole, etc., until the first is reached again. (Diagram, wheat stitch, step 1.)

Now place the needle on the right side of the short stitch, bringing it thru the middle of the strand of pine needles and under the short stitch and bring it out on the left side, i. e., push the needle in a slanting direction thru the pine strand at the first stitch. Sew into the same place with the raffia once more, carry the thread to the next stitch and repeat the binding stitch. (See diagram, wheat stitch, step 2.) This stitch is used thru all of the basket; it may be arranged in straight rows or to radiate from the center in "pin wheel" effect. Care must be taken to space the rows of stitches evenly in the beginning, as the beauty of the basket depends upon the uniformity of the stitches and general workmanship.



STEPS AND STITCHES IN PINE NEEDLE BASKETRY.

To start a basket with a woven center, the same method is used as in making a raffia basket. A strand of three-leaf pine is soaked until it will bend. Wrap one end of the pine for about an inch with raffia. (Diagram, step 1.) Now coil the end in and bind the center to the outside of the coil with over and over stitches thru the center. (Step 2.) Wrap the raffia around the pine needles twice, then bind once thru the center. Proceed in this manner until you have been around the coil once. Now start to bring the needle up thru the stitches instead of going into the center. (Step 3.) Proceed with this wrapping and binding together ("lazy squaw") stitch until the center is one and one-half inches in diameter. (Step 4.) Now start to make the "wheat" stitches about one-half inch apart.

The directions for making several of the baskets in the photographs are given by number, with the simplest one first. The shapes of the baskets, the width that the stitches are apart and the style of the handles may be changed to suit the taste of the maker, as experience will be a good teacher, and as you advance in the craft original uses will suggest themselves.

No. 1. Button Basket.

Bottom—2 in. wood, cardboard or birch bark, 13 holes, ¼ in. from edge, six-leaf pine strand.

Weave one-half inch with white raffia, "wheat stitch."

Build up abruptly until basket is 1¼ in. high, with red. Diameter 4½ in. Then build up straight with white raffia for 1¼ in.

Weave a solid row at top, "lazy squaw," 4¼ in. diameter.

Lid—Start center, "lazy squaw," three-leaf strand of pine, and weave until 1½ in. diameter.

Basket No. 1.

Stitches, ⅜ in. apart; start "wheat stitch"; use white raffia for ¼ in.; then use red for 1 in.; increase the strand to six leaves of pine needles.

Use white raffia to finish to fit top of basket or about 4¼ in. diameter. Reverse stitch on edge or place a solid row for finish.

Make a small ring handle of reed wrapped with red raffia.

No. 2. Nine-Inch Sandwich Tray (Round).

Two-in. wooden bottom. 12 holes, ¼ in. from edge.

Weave 1 in. white raffia, six-leaf strand of pine needles.

Solid row with wrapping, two binding one "lazy squaw."

Weave ½ in. with green raffia, stitches ⅜ in. apart.

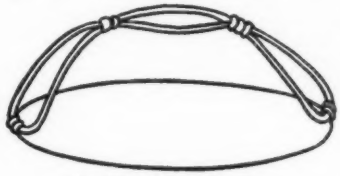
Solid row with green, "lazy squaw;" nine-leaf strand of pine.

Weave ¾ in. with white raffia, stitches ⅞ in. apart.

Solid row white "lazy squaw," nine-leaf strand pine.

Weave ½ in. with green, stitches opposite ones in previous row.

Basket No. 2.



Handle of Basket No. 2.

Wrap solid row with white "lazy squaw," nine-leaf strand pine.

Build up sides with green raffia, stitches ⅜ in. apart, one in. high, diameter at top ten in.

Solid row of green wrapped over No. 5 round reed.

For Handles—50 in. of No. 5 round reed for handle.

Wet, and splice the ends. Bend into shape and tie with raffia.

Wrap solid with heavy green raffia.

Wrap on to frame for edge of basket and bind all together (lazy squaw).

No. 3. Oval Tray (12½"x8½").

Wooden base 9½"x6", 27 holes.

Blue raffia and nine-leaf strand of pine.

Weave with blue raffia. After finishing a row reverse the direction of the long stitch, using natural colored raffia.

Weave bottom for 1¼" beyond wooden base on each side. Build up sides in the same manner, 1" high.

Finish at the top with a solid row of blue over No. 5 round reed.

For handles use 54" of round reed. Splice ends, wrap solid with heavy blue raffia. Twist thru middle. Fasten on to rim of basket with raffia, sewing over and over.

No. 4. Twelve-Inch Round Basket.

Center: Lazy squaw three-leaf strand of pine, fine white raffia for 1½".

Stitches ½" part, six-leaf strand of pine.

White raffia for 1½", red for 1¼".

Wrap solid row of nine-leaf pine needles—lazy squaw with white raffia. Start new rows of stitches ⅞" to 1" apart.

Use nine-leaf pine strand.

Weave with white raffia for ½".

Weave with red raffia for ½".

Weave with white raffia for ¾".

Weave with red raffia for 1¼".

The Baskets Described in the Text.

Solid row of white raffia, lazy squaw. Nine-leaf pine strand.

Build up sides ½" high; stitches 1" to 1¼" apart, red raffia.

Make a solid row by wrapping needles, "lazy squaw" with red raffia.

To finish the top use one piece of No. 5 reed at top to go around the circumference of the basket and to go around again allowing for a twist with a diameter of 2" for handles. Splice the ends of reed together, and tie the frame together. Set on top of basket and bind on by solid wrapping with red raffia. Place pine cones on rim to form a handle space.

No. 5. Nine-Inch Sandwich Basket.

Bottom—Three strand of pine—fine natural raffia.

Wrap pine solid for an inch, turn into a circle and insert needle in center, wrap twice, bind with one stitch, making the same start that is made in starting a raffia basket, "lazy squaw" stitch. Continue this stitch until center is 1½ in. wide. Now start the wheat stitch, placing the stitches ½ in. apart. Use a six-leaf strand of pine and natural raffia, until the basket is 4 in. in diameter. Then wrap a solid row, using the "lazy squaw" stitch with natural raffia.

Now start new rows of stitches 5-16 in. apart with green; continue for ⅜ in., then wrap a solid green row.

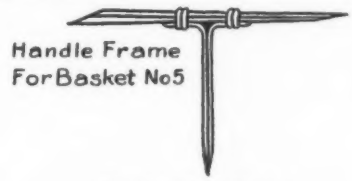
Start new stitches opposite the previous ones with natural raffia. Continue for ½ in., then wrap a solid row of white.

Start new stitches with green for ½ in., then wrap a solid row with green.

Start new rows of stitches opposite the previous ones with natural. Continue for ⅜ in. and wrap a solid row of white.

Build up the sides with green, starting a new row of stitches between each of the old rows, making twice the number of stitches. After making about five rows of green stitches use natural raffia for three rows, then green for six or until the sides are one inch high.

For handles use a double strand of No. 5 round reed; twelve pieces, 22 in. long; two pieces, 13 in. long. Find the center of the long pieces and attach the short ones to it there with three ends spliced as in diagram. The handles are 9" from center top to sides of basket, so that allows two inches at the ends to be spliced and bound to a double strand of No. 5 round reed that will exactly cover the top of the basket. Wrap the handles solid with green raffia.



No. 6. Work Basket.

This work basket has a wooden base and No. 1 reed for finish and handles. Wood bottom 8¼"x5", holes ¼" apart. Six-leaf strand of pine.

Use brown raffia for one inch, then white raffia for one-half inch. Build basket up, using nine-leaf strand of pine.

Brown raffia for one inch; white raffia for one-half inch; brown raffia for one-half inch.

For finish plait double strands of No. 0 round reed, allowing for loop handles about three inches in diameter. Bind to the basket at intervals of two inches with brown raffia.

SOME SUGGESTIONS FOR HOME OR BACKYARD PLAYGROUND APPARATUS

Designed by J. E. Painter, Supervisor of Manual Training, Minneapolis Public Schools.

IN spite of the efforts of city park boards and playground associations to provide recreation fields for the people there will always be great numbers of children who will be too far removed from these public playgrounds or too young to avail themselves of them.

While serving on a committee for the extension of public play facilities in our city, it occurred to me that something should be done for the little tots whose open air play must be confined to the home plot.

With these little ones in mind the writer offers for those who may be interested, the following sug-

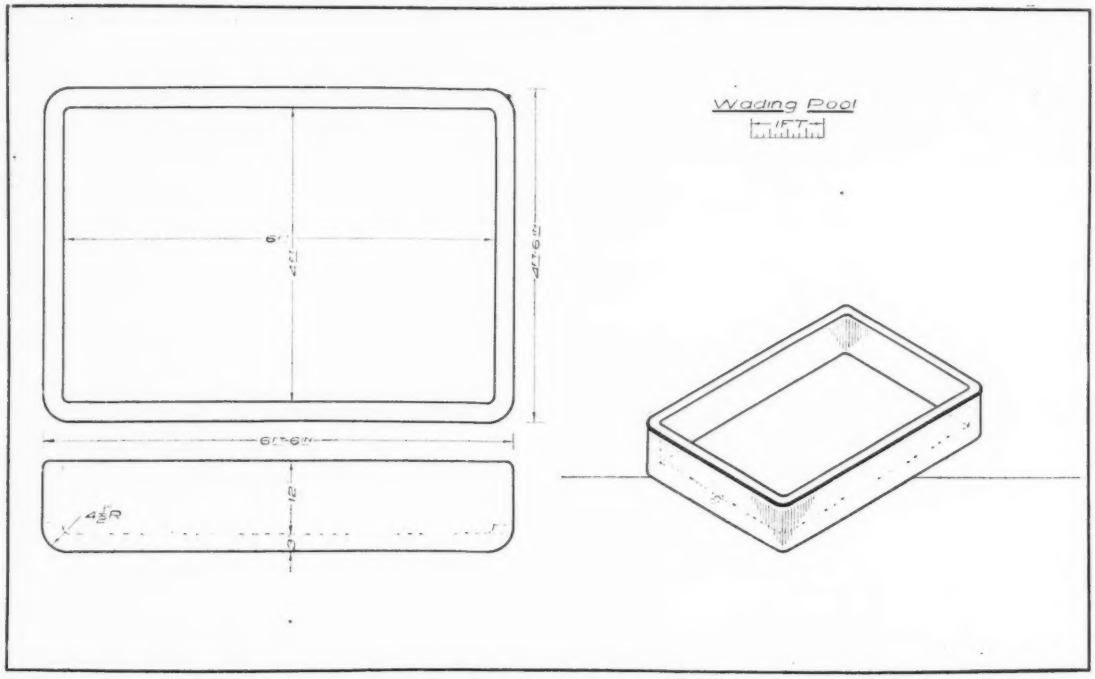


PLATE I. DETAILS OF WADING POOL.

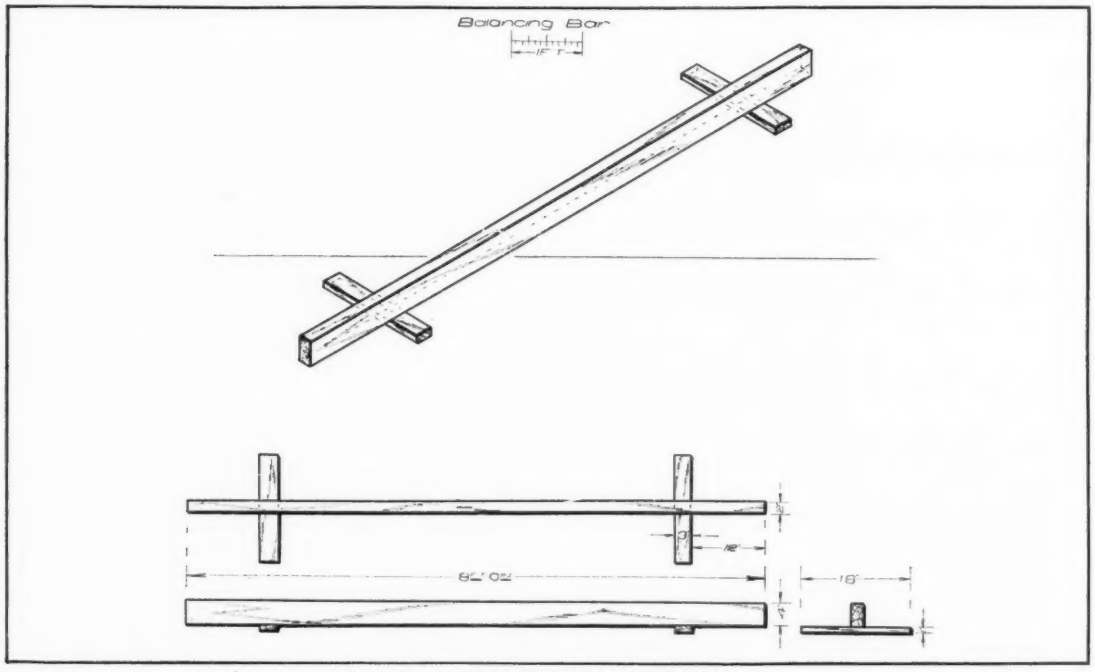


PLATE III. DETAILS OF BALANCING BAR.

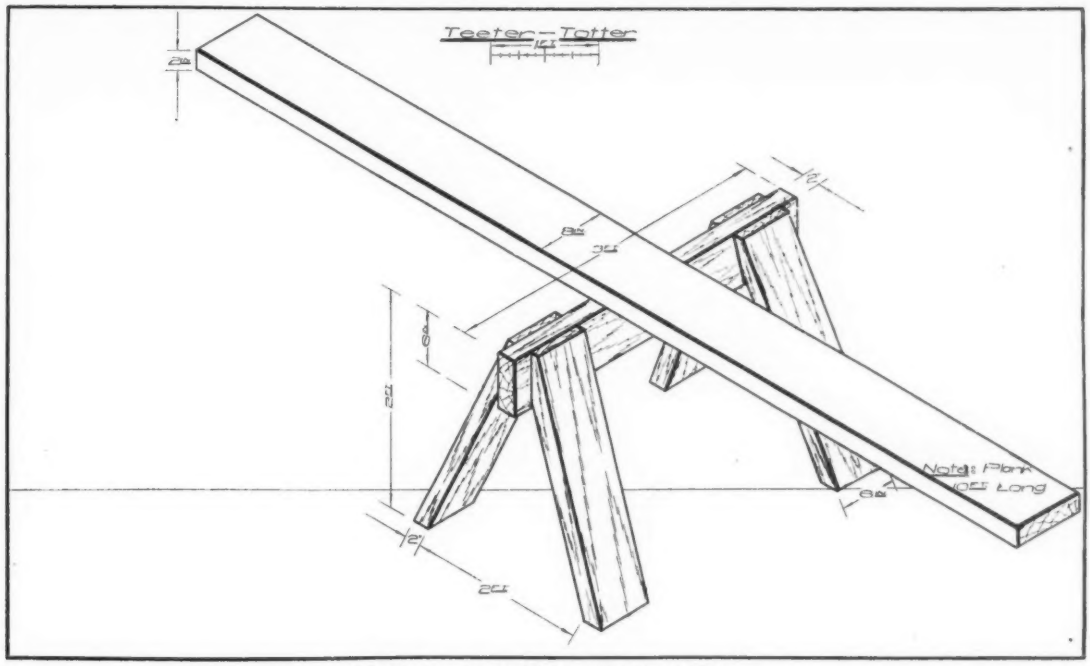


PLATE IV. DETAILS OF TEETER-TOTTER.

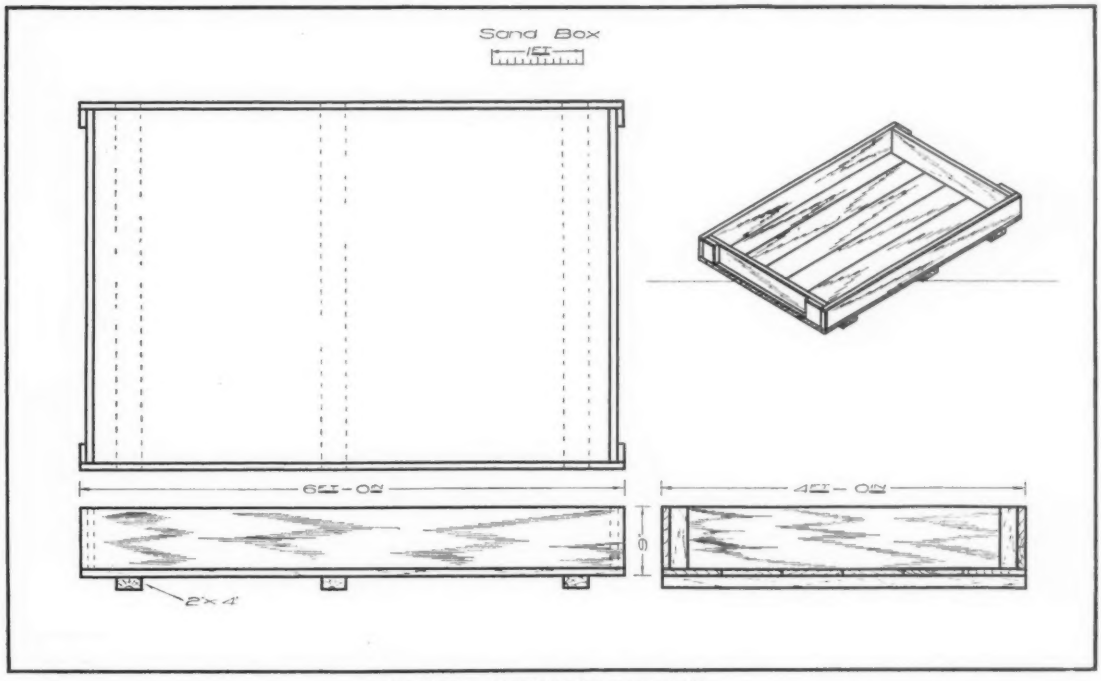


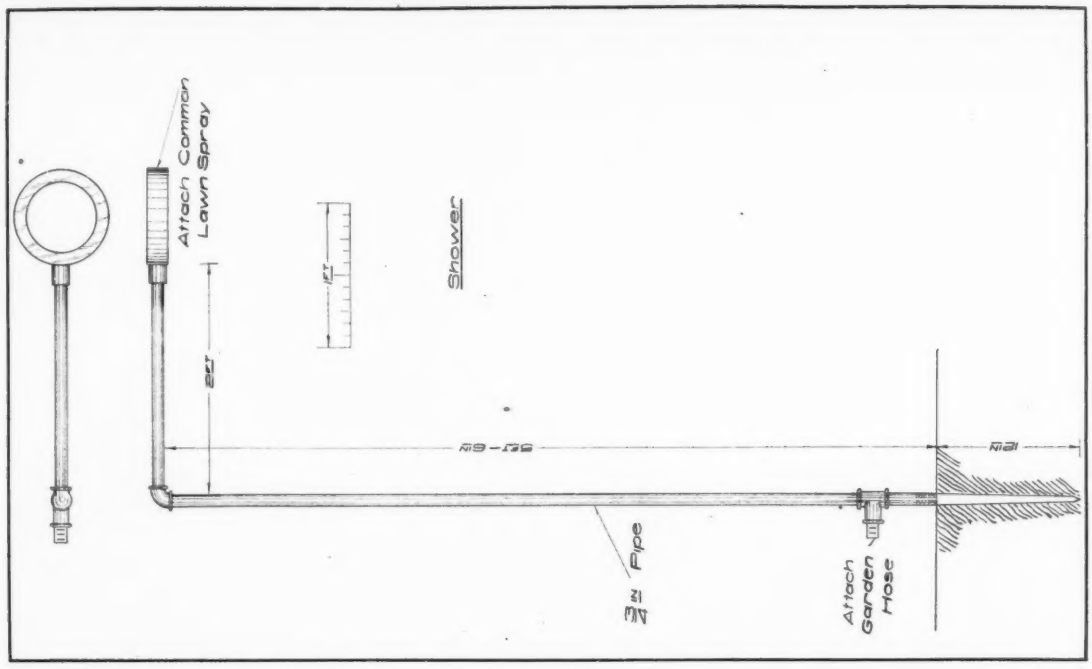
PLATE V. DETAILS OF SAND BOX.

gestions in the line of play apparatus for the kiddies at home:

All children enjoy playing in the water, and therefore no home playground would be complete without its wading pool. Plate I. This may be made of galvanized iron with a wooden frame around the top, or of concrete,—preferably the latter,—and should be set down level with the ground. A drain pipe should be provided so that the water may be changed frequently and the basin kept clean.

Who has not witnessed on a hot summer day, a group of children disporting themselves in the spray of a lawn hose and wished he were a child again? The *shower*, Plate II, requires but a few feet of ordinary water pipe in addition to the lawn hose and spray. The sharp spike at the bottom makes it possible to plant it anywhere desired.

The balancing bar, teeter-totter, and sand box, Plates III, IV, and V, offer variety of amusement and will keep the little ones busy for hours at a time.



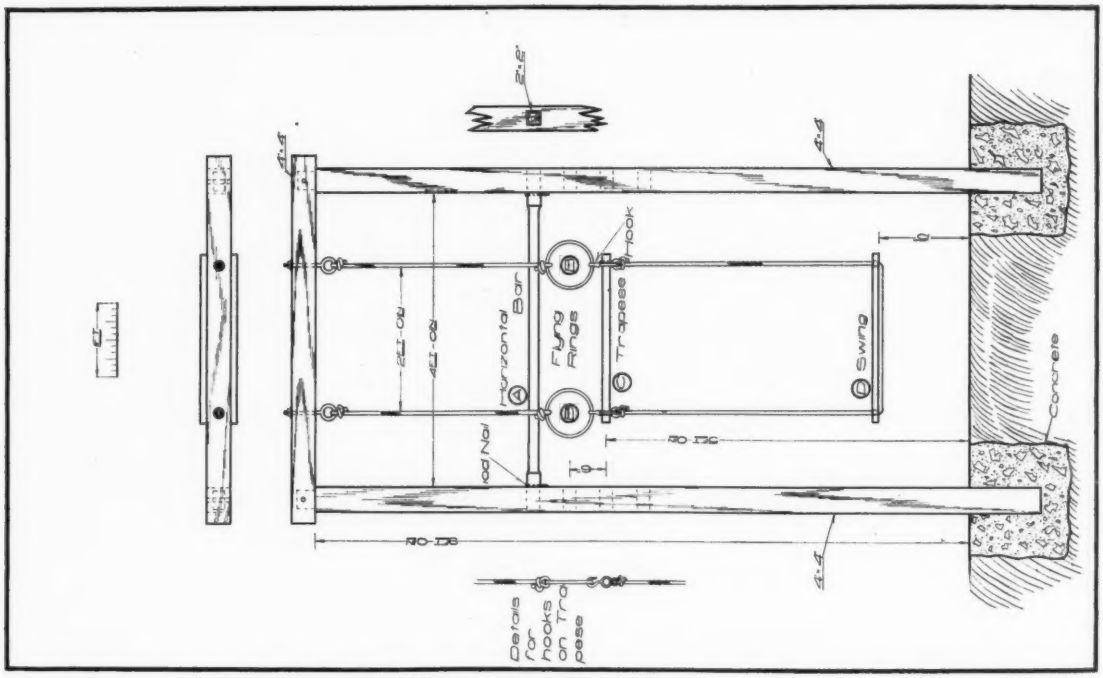


PLATE II (Above). PLATE VI (Below).

The sand box should be provided with a cover to keep the sand dry when it rains. This cover should be made in two parts, the division coming on a center line running lengthwise of the box. To cover the open joint between the two parts fasten to one part a strip or cleat about three inches wide. These parts of the cover placed on the ground on either side of the box will protect the children from the dampness of the ground when at play.

If one wishes to go still further he may add what, for want of a better name, I have designated as the many-in-one apparatus. Plate VI. By fastening the ropes to the horizontal bar by means of stout cords we have an easy, safe swing for the wee tots. By removing the horizontal bar we have the giant swing for the older children. Unhook the lower part of the swing and we have the trapese. Remove the trapese and the flying rings are ready. Fasten the flying rings to the side columns or throw them over the top of the frame and all is clear for the horizontal bar, which may be adjusted to any desired height.

PRINTING—A VITALIZER OF SCHOOL WORK

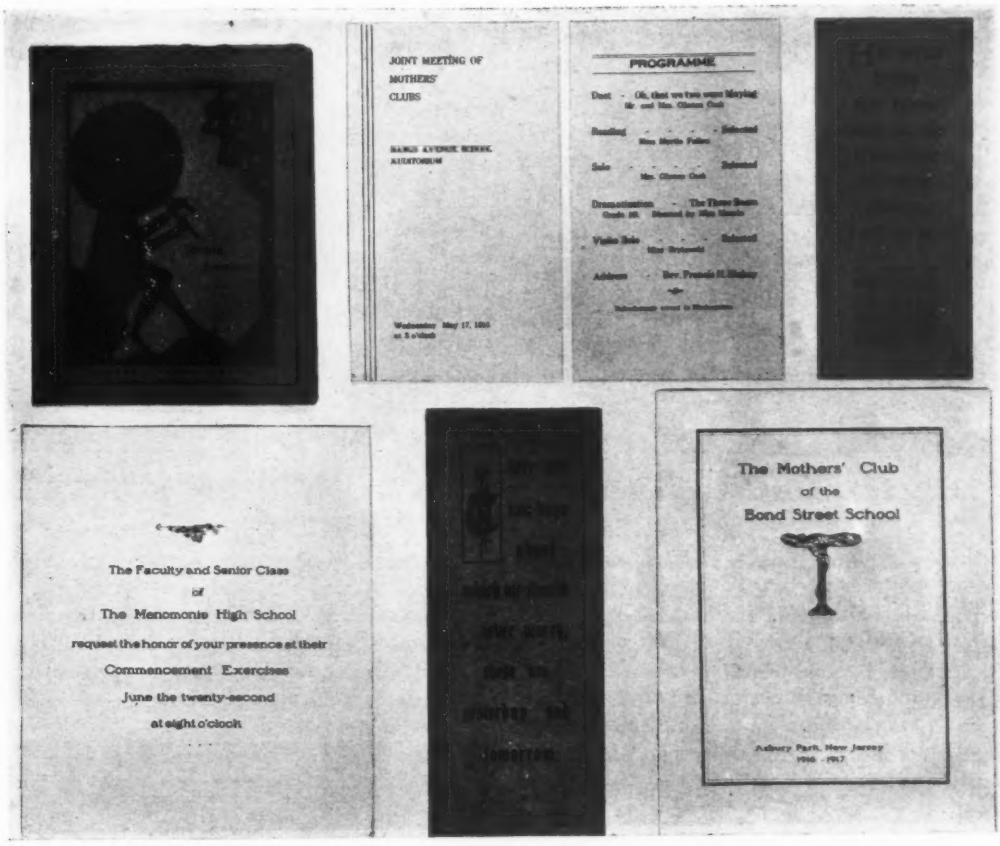
Wm. J. Barry, Asbury Park, N. J.

PRINTING belongs in the school for its educational value. It is a vitalizer of dead school work. It is a promoter of taste and skill. The most obvious result of printing should be its effect upon the English work. The conscious attention to all form results in correct spelling. The child also attains a knowledge of paragraphing, the meaning of punctuation marks and the correct use of capital letters. He notices the forms of verse and styles of expression. He becomes careful and accurate because his work demands care and accuracy, and children naturally respond to the inherent demands of their work.

Printing offers a general training which fits the boy not only for printing as a vocation, should he in later life elect it, but for any other vocation in which is demanded a culturated artistic sense. It makes his school work interesting and often holds him in school much longer than he would remain otherwise. It should be an incentive to do his other school work well.

The course in printing at Asbury Park has been emphasized more than ever. There seems to be no part of our school activities that are not continually aided and abetted by the productions which come from our "Manual Arts Print Shop."

The business department of our board of education, instead of sending to a local printer for letterheads, bill forms, schedule cards, order blanks and the multitude of other forms needed in carrying on the work, makes up its requisition for enough in advance to enable the school boy printers to get the work out themselves, at a large saving to the board of education.



SAMPLES OF SCHOOL PRINTING PRODUCED BY THE SCHOOL SHOP, ASBURY PARK, N. J.

For entertainments the schools themselves provide the tickets and programs; for the domestic science department they are engaged in printing a one hundred page cook book or course of study, the cost of which will not exceed four cents a copy. About five years ago a small supply of these very books, purchased from a local printer, cost the board $125, or about 35 cents each.

A good system of medical inspection necessitates the annual consumption of a large supply of card forms. These are furnished by our juvenile "jobbers" who have even gone so far as to set up medical notices in foreign languages, a laborious but necessary pro-

ceeding, to encourage in foreign born parents the proper supervision of their children's health.

It might be supposed that local printers would offer at least a feeble objection to the school authorities because of the loss of a considerable amount of jobbing each year. On the contrary, three of our local establishments have co-operated wonderfully in saving for us their type cases and other equipment for which they had no further use. When a job requires a certain character not contained in our fonts or a particular cut which would be expensive for us to procure, we have merely to ask for the loan and our local printers gladly assist.

Nor should it be taken for granted that a large sum is necessary in order to introduce printing into schools of an average city or town. Our enrollment for all grades is a little over three thousand and we have 185 boys taking the course in printing. The initial cost of our shop equipment was $492. Since that time, 1913, of course additional equipment has been secured, a little each year, so that the actual monetary burden is of small moment, despite the fact that our needs are growing apace with the added popularity of the course. Five hundred dollars, however, is sufficient for a beginning, in the average district. And once begun, there is not the slightest possibility of ever abandoning the subject, for the interest of the pupils and the co-operation of the school authorities, who may see tangible results, will never decrease.

In connection with the matter of finances, a self-supporting department is by no means rare. Taking into account the savings effected in ways just mentioned, and adding to that whatever moneys may accrue from the sale of school calendars at Christmas time, post cards at Easter and cook books at any time, the real financial situation is rendered a thing of little importance from the standpoint of the people who must meet the bills.

Printing, I have noticed, is an incentive which impels a pupil to do his other school work well. In substantiation of this, I cite the case of our seventh and eighth-grade boys, who have one ninety-minute period each week. In order to secure more time in the print shop, the boys who do good work in their regular grade rooms are allowed extra time, provided they prepare their lessons the night before and hand in written work before going to the shop. They also work after school hours and on Saturdays when their work requires it.

The boy in the print shop derives an advantage which no other department can offer. He knows he is doing something which is of immediate need and value in the school and feels he is a real contributor to the welfare of the school and of the community.

In the study of printing, then, he unconsciously casts all selfish motives aside and enters into his work with a keen sense of enjoyment and a feeling that he is doing something which is really worth while.

THE MAKING OF ONE HUNDRED CHECKER BOARDS AND 2,400 CHECKER MEN

H. P. Gerber, Instructor in Woodwork, Northern Normal and Industrial School, Aberdeen, S. D.

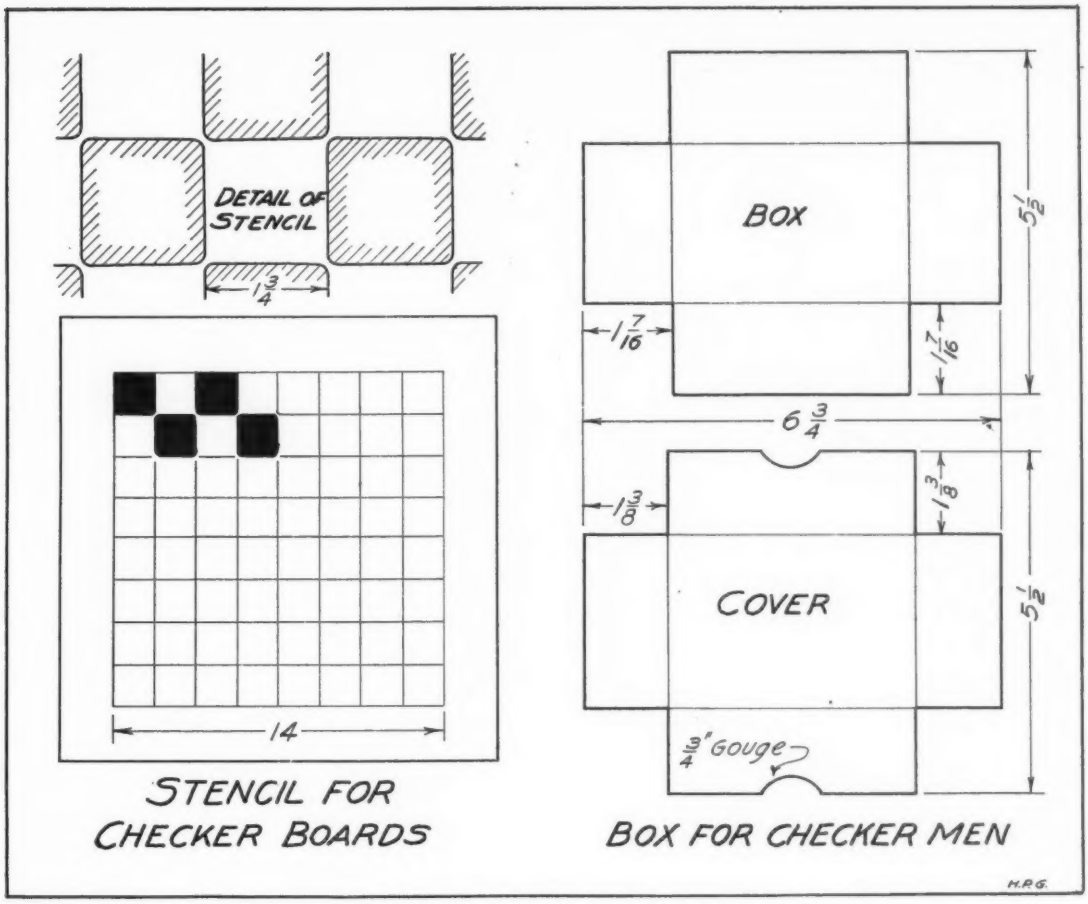
AFTER having made about five hundred knitting needles and several other Red Cross projects we were anxious to attempt something more comprehensive in the "War Problem" line. After casting about we found that checker boards and men were needed in the Y. M. C. A. recreation camps. The following lines explain how we made one hundred boards and twenty-four hundred men in record time at a cost of about eleven cents per set.

Making the Boards. We ordered ten pieces of three-ply gum 30″x72″. These were cut into fourteen-inch squares with but one setting of the ripping fence. The combination or mitre circle saw was used to secure a smooth edge that required no further dressing.

A stencil was made from a piece of medium-weight tag board, cutting straight edges with a knife and round corners with a small gouge.

In view of the fact that it was desired to turn these boards out as soon as possible, a stenciling paint that would dry quickly and at the same time leave a dense flat tone was necessary. Lamp black and boiled oil were mixed to a smooth but heavy composition and thinned with Japan drier to the consistency of cream. Since the department owned but one stencil brush it was necessary to keep a boy from each class stenciling thruout the day. On the second day the

Making Boxes for Checker Men.



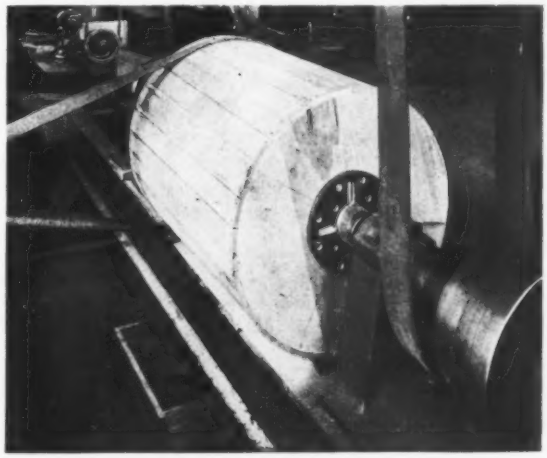
DETAILS OF CHECKER BOARDS AND BOXES.

boards were given two coats of thin white shellac to produce a smooth wearing surface. On the backs of the boards the school name and location were painted with a stencil cut on a machine by one of our wholesale houses.

Making the Checker Men. For the checker men we ordered 120 feet of $1\frac{1}{4}$" maple dowel rod. The firm, however, sent us birch instead of maple, but it suited the purpose nearly as well, so we registered no complaint. These rods were cut into pieces 5-16" in length, using the combination saw for a smooth cut and a stop on the guide.

Using the Rattler. In order to smooth up the edges and surfaces the men were rattled for about an hour in the crude device illustrated in the photograph. This rattler was constructed of basswood, one inch stock for ends and one-half inch stock for lateral surface. It was a temporary affair made for this job. It measured nineteen inches in diameter and thirty inches in length. It was mounted on a twenty-inch swing pattern maker's lathe. To secure a low speed a belt was passed around the rattle and over the smallest step of a head stock cone pulley on a small lathe, which stood just behind the large one and acted as the driver. The belt was crossed to reverse the direction in order to prevent rattler from turning itself off the spindle, it being fastened to a face plate as shown. In this way a maximum amount of contact was also secured on the small cone pulley.

If these two lathes had not been conveniently located we would have constructed a bearing support for the rattler on the floor, and in line with the lathe head. As the speed is low this construction could be very light.



Rattler Made for Finishing Checker Men.

STENCILING AND SHELLACING CHECKER BOARDS.

Dyeing. Twelve hundred men were dyed red in a hot solution of red and brown mahogany powder stain and water. The two powders were mixed until the proper shade was secured.

After thirty minutes of soaking the men were removed by means of the wire mesh containers and placed on the steam coils in the drying chamber used for drying bent wood products.

As our stain pan was rather small we had to dry the men in four batches. However, it worked rapidly at that and we saved stain.

For the black men we used a solution of gun metal and powder stain and hot water.

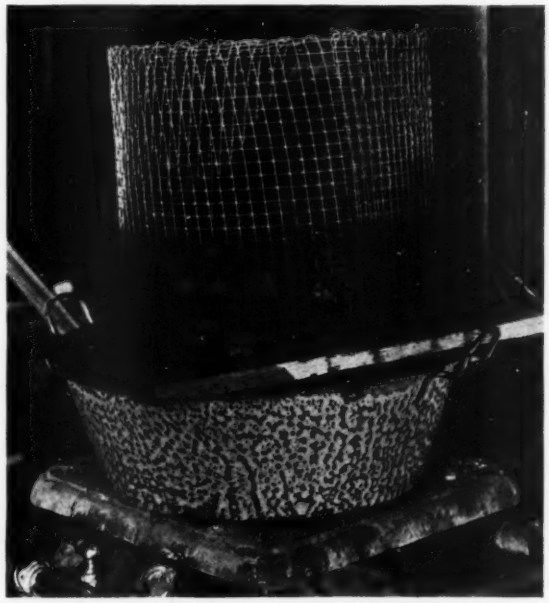
In forty-eight hours the men were dry and ready for the final touch.

Polishing. The twelve hundred red checker men were placed in the rattler with a small quantity of orange shellac and raw linseed oil and allowed to rattle for about twenty minutes. This procedure was repeated four times and produced a good polish on all surfaces. The black checker men were then treated in like manner.

Boxes for Checker Men. One hundred boxes were made to hold 24 checker men each. The box and cover were made from the same size stock as indicated by the drawing. Pulp board and gummed stay tape were used. The photograph illustrates the process of making.

These checker men and boards were sent to a Y. M. C. A. secretary in Chicago to be distributed among the cantonments in the central district.

The boards are light and substantial and will stand much more service than any paper or cardboard affairs.



Arrangement for Dyeing Checker Men.

PREVOCATIONAL TRAINING FOR GIRLS AS CONDUCTED BY THE NORTH BENNET ST. INDUSTRIAL SCHOOL, BOSTON

George C. Greener, Director

ONE of the deepest concerns of educators is to devise ways and means of holding in school a larger percentage of the children who enter industry at an early age. Boys and girls alike must contribute to the family income; and they are, as a rule, more than willing to exchange lessons and leading strings for a pay envelope and the independence which goes with it. Whether to remain in school or to go to work does not always constitute a real issue in their minds, for they are seldom sufficiently interested in their school work to wish to continue it. The academic program of the two upper grades grows more and more uninteresting and irrelevant to children whose minds are increasingly occupied with the near realities of daily wage-earning, and the small amount which such children are able to earn at unskilled labor is still large enough to form a welcome, if not a necessary, addition to the family income. The child's lack of interest in the formal work of the school, his longing for independence, and the economic need of the family all combine to fix the customary school-leaving age at the earliest birthday legally permitted. More and more efforts are being made to demonstrate to parents the real economy of further training for their children in the schools, that they may be better prepared and able to earn a higher wage.

The child labor law of Massachusetts permits children who are 14 years of age and who can do the ordinary tasks of the fourth grade to obtain employment certificates. The requirement of the fourth, rather than the eighth grade, is a concession to the backwardness which is known to exist in some public schools. The two upper grades are seriously depleted because many children leave school without having finished the full grammar course. Children who have fallen behind in their school work and find themselves in classes with younger pupils are eager to escape this embarrassing situation. Indeed, there is little use in their remaining under a purely academic regime, for children will not learn that in which they have no interest. If they do remain, the school should give them the kind of training that enables them to make some progress and experience some feeling of achievement. They must be given a chance to make good with their studies. It is difficult to arouse ambition in children whose school life is one long failure.

Children of the North End.

The educational experiment described in this paper was developed to meet the needs of children who go to work at the age of 14. The North Bennet Street Industrial School is an institution for experiment and research in educational and social methods. To meet these special conditions, the school has become a laboratory for educational adjustments. Industrial processes have been introduced into the curriculum, tho the aim is not merely to teach processes as such. They are used as subject-matter by means of which children may be taught to think out reasons and to make future plans. As Mr. Abraham Flexner says in his recent paper on the modern school, "If children are to be taught and trained with an eye to the realities of life and existence, the accessible world is the laboratory to be used for that purpose." The children who attend this school grow up within sight of the Old North Church and other historical landmarks which serve to make the inspiring past history concrete and real to them. By constant association, the idea of American independence becomes a part of their daily lives rather than a remote and traditional fact. In the teaching of civics and history and in building up ideals of citizenship, the familiar monuments of the neighborhood are one of the valued resources of the instructor.

In the same way, the school seeks to develop the kind of education which is related to the children's immediate social and economic environment. The building is located at the center of a densely populated district; 35,000 persons live within a radius of four blocks. The neighboring families are mainly Italians, and there are a few Polish residents. A fairly uniform standard of living prevails in the quarter, for industry is the determining factor in fixing the local conditions of life. It is the prevailing custom for children of both sexes to go to work at 14.

Purpose of the Prevocational Class.

The prevocational classes of the North Bennet Street School were formed for the purpose of prolonging the child's school life, so far as this can be done by holding his interest and so far as the child has any choice in the matter. But if the child *must* go to work on the stroke of 14, the prevocational class is an attempt to give him some preparation for the wage-earning world. As a means to both ends, these classes offer a modification of the upper grammar school course so that, in method and substance, it will be especially adapted to pupils who will leave school early to enter industrial pursuits. The instruction given is designed *to prepare* them for industrial employment tho not *to completely fit* them in any technical sense. The graduate of the prevocational class, tho still immature in years, does not enter industry blindfolded.

The prevocational class is justified primarily on grounds of timeliness and foresight. Children must be given a proper attitude toward their vocational careers before they have passed entirely beyond the reach of educational influences. But the prevoca-

tional class also serves another function. It provides a better form of general, or liberal, education for motor-minded children,—that is, children whose mental ability can be best developed by the development of their manual ability. The opinion is gaining ground that the inflexibility of traditional education does not correspond to the diversified needs and capacities of the great masses of school children. Hitherto, the classic curriculum has been upheld at whatever cost to the individual pupil. Children who could not measure up to the standard remained in the fourth, fifth, or sixth grade and were stigmatized as failures. But now, after many years, we are beginning to perceive that these children also are educatable when the proper methods are employed. The school must consent to study their fundamental tastes and interests and to formulate its instruction in such a way as to appeal to them. In the prevocational class, interest is stimulated by the use of concrete material, by the adaptation of tasks to ability, and by vitalizing the instruction thru its vocational outlook.

Young Girls in Industry.

The foregoing considerations apply to children of both sexes. Indeed, if we examine the census statistics concerning child workers in Boston, we shall see how important it is that prevocational classes for girls should be maintained on the same basis as those for boys. In 1910, according to the Federal Census, 2,639 children under sixteen were employed in industries of Boston; 1,288 boys, and 1,351 girls.

As already stated, the education of children who leave school at 14 should necessarily differ in method and content from that of children who remain two, four, or six years longer. Since girls form more than one-half of the children's contingent in industry, they need the kind of school work between 12 and 14 which will safeguard them as wage-earners between 14 and 16. They also need to have their interest awakened by vital activities to counteract the school-leaving tendency, which they manifest no less strongly than their 14-year-old brothers.

Social workers know from personal contact with these families,—and their observation is confirmed by a study of the census statistics,—that the obligation to earn laid upon the adolescent daughter is no less strong than that laid upon the son, and that her *sense* of obligation is often stronger than his. Not only her own well-being but that of the family to which she belongs is improved by the type of instruction which leads to a more intelligent selection of occupation and to advancement in that occupation. Influences which help to make her industrially and socially more efficient are influences which reach the whole family group.

History of Girls' Prevocational Class.

The first prevocational classes for girls which were started in Boston or, as we believe, in this country, were started by the Board of Managers of the North Bennet Street Industrial School. In September, 1907, a class of fifty girls was received from the Hancock School for ten hours of industrial training per week. These girls were selected from the sixth and seventh grades by the principal of the school in conference with the committee from the board of superintendents. They continued to carry on their work in English, arithmetic, and geography with their regular classes, reporting at the North Bennet Street School for industrial work and at the Hancock School for academic work. Their time was divided between academic and industrial work in the proportion respectively of $6\frac{1}{2}$ hours to $3\frac{1}{2}$ hours.

In this form the experiment of working out a method of co-ordinating academic and industrial instruction was begun. A house adjoining the North Bennet Street School was remodeled for this work. Three of the seven rooms were furnished as dining-room, kitchen, and bedroom, respectively, and the remaining rooms were equipped for classrooms in sewing, textiles, and design. All of the rooms were well lighted and attractive, and afforded an opportunity to apply lessons in housekeeping and house-furnishing on a family scale.

In selecting the forms of vocational work most suitable for girls in elementary schools, it was necessary to bear in mind the two-fold need of these immature pupils. Their immediate need was preparation for an effective vocational career,—self-support and social security, so far as these could be insured. Besides, their eventual need was training for the various occupations and duties which make up home management. Those who planned the instruction realized, however, that direct preparation for home-making does not awaken the same interest in girls of 13 as such instruction would arouse in them at a later period, when marriage and the direction of a home should become near realities.

Of no less importance than the kind of work to be taught was the inculcating of the right attitude towards work. Interest and initiative were the things which the girls chiefly lacked and which they most needed—whether the instruction given pointed toward wage-earning or home-making. The power to assume responsibility was the primary need of those girls who would be called upon to manifest it at an early age. For this reason, the whole matter of the household duties and the care of supplies and equipment was entrusted to them with gratifying results. The girls began to ask for the privilege of assuming responsibility and to show greater ambition in their academic work. Their former principal and teachers stated that they had matured and awakened to a marked degree. As the result of the first year's experience, it was decided to continue the class and to endeavor to correlate more closely the work done in the Hancock School and that done in the North Bennet Street Industrial School.

In September, 1910, the entire work was reorganized for the purpose of securing greater correla-

tion than was possible under the existing plan. In the petition to the Boston school committee which outlined the prospective plan, this statement of a fundamental principle of prevocational training was made: "Industrial training as a *subject* alone is not right. It leaves the academic work unrelated and uninterpreted. The saving of time which might be effected by close correlation is not secured for the child. Both academic and industrial training need to be given in the same building and under such conditions that a method and not a subject will be developed."

Under the new plan, the North Bennet Street School assumed the full responsibility for housing and

DINING ROOM IN THE NORTH BENNET STREET INDUSTRIAL SCHOOL.

instructing a class of 25 in place of the half-time school for a class of fifty. The class was made up of pupils selected by the master of the Hancock School in conference with the director of the North Bennet Street School. The girls were to be not less than 13 years of age and up to, or above, the rank of fifth grade. Where it was possible, preference was given to those who would probably be deprived of a high school course and who indicated their intention, supported by their parents' consent, of remaining in the class the entire year. The first class of 25 was drawn from the 35 pupils who applied for admission. The class was subsequently enlarged to provide for fifty girls, and the course was extended to cover two years.

Course of Study.

The prevocational class, like the other public grammar schools of Boston, is in session from 9 a. m. to 12 m., and from 1:30 p. m. to 3:30 p. m., daily, except Saturday. Pupils of the senior cooking classes serve a noon hour lunch in the lunch room, and are given their own luncheon.

The complete program of the prevocational class as used in 1916-1917 is given in the following outline:

Junior Class.	Minutes per week
Cooking and housekeeping	240
Sewing	240
Mending, or special work, as box-making	60
Laundry	60
Printing	90
Design	90
Arithmetic	160
Spelling	45
Music	60
Penmanship	30
History or geography	90
Language and composition	100
Literature and reading	80
Current events	20
Hygiene	30
Folk dancing	30
Recesses, etc., physical training	45
	1,470
Senior Class.	
Opening exercises	15
Cooking in lunch room	150
Housekeeping	150
Serving in lunch room	120
Dressmaking	300
Mending	45
House cleaning	45
Laundry	90
Printing	90
Music	60
Arithmetic	150
Spelling	50
Geography or history	90
"First aid"	30
Language and composition	100
Literature and reading	80
Design	90
Current events	30
	1,685

Academic Courses.

(Reading, Spelling, Arithmetic, etc.)

The aim of the prevocational class is to unify the instruction in such a way that the vocational and academic elements are used to interpret each other. Arithmetic, for instance, is closely related to the industrial subjects of the course. The sewing class begins in the Fall with a thoro study of the tape measure. The yard and its fractions are taught by practice in buying and selling and on dressmaking problems. One pupil becomes a saleswoman in a department store and the rest of the class are customers. The saleswoman must measure off 27 inches of lace and compute its cost at 75 cents a yard, etc. In the cooking class, the measuring cup becomes a basis for the study of fractions. The girls often divide recipes so that they must find a half of three-fourths. Percentage and discount are learned as practical operations in connection with savings bank accounts and life insurance payments. The largest resource for arithmetic is in the lunch room accounts.

In a similar way, other subjects are related. Spelling lessons include the names of sewing materials, tools, and processes. The cooking class becomes familiar with the names of common foods, while very interesting reading is done along lines of clothing, feeding, and housing people. Geography takes on a new meaning. It is not a thing of maps and definitions. Thru it the pupils discover where the materials with which they are working are found or made, how they are prepared for market, and thru this method they naturally learn for what harbors and rivers are used and how great cities come to be, while the laws regulating manufacture, export, and import assume concrete outlines. By means of this method of correlation, it is possible for the class to study a subject more intensively than would be possible under the traditional method of unrelated subject-teaching.

Since prevocational work for girls is of such recent origin as an educational experiment and since it has been developed by the North Bennet Street School with such marked success, it seems worth while that the courses employed should be given here in detail. The courses represent a series of modifications based on several years' experience, and while they are not literally adaptable to any and every community, they illustrate the method by which such adaptation might be made.

The content of the several courses is given in the following outlines:

Arithmetic.

1. Oral drill on fractions of a yard; oral drill on fractions of a dozen; oral drill on fractional parts of a dollar. The fast rule.
2. Written problems involving these fractions.
3. Whole numbers: Number facts; weekly drill on quick work in fundamentals; reckoning lunchroom accounts; profit and loss from lunchroom accounts; economy in buying.
4. Fractions: Drill in processes; application in finding cost of garments; sewing materials; multiplying and dividing recipes; reckoning sales slips.
5. Percentage: Table of easy per cents; commission, 10% for selling products of lunchroom, 2% sales girls' commission; discount, 10% dressmaker's discount; discounts for cash.
6. Interest: Fire insurance—insuring our own school building; endowment insurance vs. life insurance—savings accounts, postal savings, personal savings account, co-operative bank accounts.
7. Accounting: Daily marketing book. (Lunchroom); bills; receipts; cash books; cashiering (making change).
8. Areas: Applied to carpeting rooms at home, etc.

Geography.

First Year.

1. Workers.
2. Non-workers.

Young children, the old, insane, etc.

Workers in the United States.

1. Extractors: Farmers, planters, lumbermen, miners, quarrymen, fishermen.
2. Transporters: Those engaged in commerce; commercial cities; steamboat lines; principal railroads; history of transportation in United States; early gold seekers.
3. Transformers: Manufacturing of such articles as flour, furniture, steel goods, textiles, etc. Effect of nearness of coal and iron; water power.
4. Transferrers: Trade centers.
5. Professionals: Nurses, teachers, doctors, policemen, writers, etc.

(Maps showing areas and cities engaged in each occupation.)

Supplementary Reading: How the world is fed; How the world is clothed; How the world is housed; How we are fed; How we are clothed.

Second Year.

1. Review five classes of workers in the United States.
2. Study five classes of world workers.
3. Textiles.
   Raw Products:
   a. Principal Fibers: Vegetable (cotton, linen, wool, silk); Animal.
   b. Sources of Fibers.
   c. Uses.
   d. Characteristics.
   Finished Products.
   a. Processes in manufacture: preparation for spinning, weaving, dyeing.
   b. Study of cloth.
4. United States in its commercial relations.

History.

1. When and where history began and how it relates to man's progress.
2. Written records: Books, inscriptions, remains.
3. Prehistoric people of Northern Europe: Cave dwellers, lake dwellers.
4. Brief study of early history of: Egyptians, Babylonians, Hebrews, Greeks, Romans, (conquest of Britain), Britons.
5. N. A. Indians: Savages, barbarous and half civilized tribes.
6. North America: Reasons for discovery and explorations; colonization; French vs. English; Causes of Revolution; Revolution and its relation to our community; New Government—constitution, currency, tariff; Territorial growth; Inventions and their relation to our everyday lives; Causes of Civil War—slavery, Reconstruction Period.
7. Industrial History: Development of lighting and heating from the pine-torch to electricity, and the fireplace to the furnace. The sewing machine and its effect on industrial life of today.
8. Civics: Citizenship, naturalization, voting, duties of the individual to the community, city government.
9. Current events: (Much of our history leads back from the present into the past.) Present federal administration as a starter tracing back thru the years to revolutionary days.

Literature.

1. Aim: To lead pupils to habits of reading good books by presenting stories, poems, etc., in such a way as to arouse interest and enjoyment.
2. Method: Books, etc., to be presented by the teachers by reading most vital parts and telling the connecting parts in story form. Pupils keep record of books read.
3. Suggestive reading: Story of Joseph; Secret Garden, Burnett; Odysseus, Homer; Evangeline, Longfellow; Merchant of Venice, Shakespeare; Vision of Sir Launfal, Lowell; Tales of a Wayside Inn, Longfellow; Rip van Winkle, Irving; Christmas Carol, Dickens.
4. Memorizing poems.

Language and Composition.

1. Sentence: Sentence building (sub. and pred.), sentence enlarging, vocabulary work.
2. Letters: Letters to friends, letters of thanks, letters of invitation, letters of request. Business: Letters of applica-

AN ANNUAL EXHIBITION OF SEWING, NORTH BENNET STREET VOCATIONAL SCHOOL.

tion, letters ordering books, etc., envelopes, placing address correctly.

3. Themes: A study of form. Items for "Lantern," Subjects for geography and history.

4. Correcting common errors in speech, punctuation, etc.

Elementary Science.

Explanation of: Gas meters (reading of), thermometers, barometers, water filters, furnaces, hot water and steam heat, ventilation, fireless cookers, thermos bottles.

Color, Design, Construction.

Course: Applied to home-making; applied to dressmaking; applied to menus, candle-shades, book covers, port-folios, etc.

Materials: Collection of illustrations from magazines, wall papers, chintzes, textiles, etc.

Hygiene.

1. Importance of health.

2. Structor of body: Bones, muscles, organs, circulation, nervous system, other parts.

3. Personal care of body: Eyes, teeth, skin, hair, hands. The use of public bath houses.

4. Laws of health: Food, fresh air, pure water, suitable clothing, recreation, dangers of alcohol, tobacco, etc.

5. Causes and prevention of contagious diseases—tuberculosis. Hospitals, clinics, private dispensaries.

First Aid.

Bandages—rolled, triangular.
Dressing sores and cuts.
Emergency aid—symptoms and treatment.
Emergency case (cost 5c).

Music.

It is not intended that the prevocational classes should become too much industrialized and that cultural values should be lost sight of. Music, folk dancing, and literature come on alternate mornings. The aim of the music course is to give the pupils increased knowledge as a better foundation for appreciation and enjoyment. Singing and vocalizing exercises are supplemented by the study of composers of all nationalities and their most popular compositions.

(*Conclusion in June Issue.*)

AS final maxims: never forget the material you are working with, and try always to use it for doing what it can do best: if you feel yourself hampered by the material in which you are working, instead of being helped by it, you have so far not learned your business, any more than a would-be poet has, who complains of the hardship of writing in measure and rhyme.

William Morris.

INDUSTRIAL-ARTS MAGAZINE

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EDITORIAL

VOCATIONAL EDUCATION AND DEMOCRACY.

EVERY little while, someone breaks forth in lamentation and warning lest "democracy be driven from our schools" by the introduction of vocational work.

We are frank to confess that we do not share in any such fear. We are firm in the belief that vocational education will *put democracy into the schools* as no other agency possibly could.

Is it democratic to insist that *all* children without regard to their natural aptitudes and their future work, shall take the same identical courses? Is it a democratic institution that drops the vast majority of its constituency prematurely and that drops them totally unprepared for any kind of remunerative work? Yet those who profess alarm at vocational work have stood by all these years and never raised a voice against the *undemocratic* conditions. The states have established great universities of which we are all proud. The various communities have built splendid high schools. For the boy who is so fortunately situated as to be able to go thru these excellent institutions, the public actually spends hundreds of dollars a year. This is as it should be. But is it *democratic* to do this for one class of boys, and for another class who must go early to work, to do absolutely nothing? If democracy means equality of rights, privileges, and opportunities, shouldn't it operate in both cases? Should not the boy who *must* go to work have at least some chance to prepare himself for success in his work?

Those who confess to a fear of vocational education make three perfectly erroneous assumptions.

1. That boys and girls will stay in school until they have finished the traditional courses.

2. That culture and refinement come only from books or from abstract matter unrelated to life's real activities.

3. That there is something essentially degrading in the work demanded by society which totally unfits it for school purposes.

With reference to the first assumption, it is only necessary to point out that the entire experience of the public schools proves the contrary. It is not even necessary to go into the merits or demerits of the courses offered. However valuable the intent and content of such courses may have been in theory, the fact remains that they have not appealed to the pupils and their parents as valuable, worth-while, or necessary. The still further fact remains that such courses made no pretence of giving preparation for any kind of profitable employment. Hence, boys and girls in great multitudes dropped from the schools with neither the training in the traditional courses nor training that would in any way serve them in the very practical business of making a living.

The second contention is a species of medievalism that unfortunately still persists in some quarters. This is the attitude that the working girl faces who carries her lunch in a music roll. It is this cold, relentless attitude the unfortunate man must face who finds himself suddenly thrown from affluence to the uncertain resources of his daily toil. The educators at all worthy of the name, have already accepted the proposition that the theories, scientific data, and the technical requirements that underlie success in the industrial world together with the intercourse with the men and women of affairs are fully as potent instruments of culture and refinement as are the sacred subtleties of classic lore.

In answer to the third proposition, we desire to call attention to the fact that to follow a skilled trade is a perfectly worthy ambition; and further that a skilled trade may be fully as remunerative, useful, and respectable as a socalled "profession." Those who set themselves up as guides to the youth of the land should not hesitate to accept this conclusion and to put themselves at once to the task of giving intelligent and comprehensive guidance toward the fields of industrial occupation. The part the skilled artisan must play in the present crisis is an unparalleled example of the almost helpless dependence of this and all other countries, both in war and in peace, upon the mechanical skill and genius of the men and women who work with their hands.

It will never militate against democracy to increase the power and knowledge of the people in doing the necessary work of the world.

THE POSTER COMPETITIONS.

THE Art teacher may no longer feel neglected and unable to do her bit. The art instruction in our schools can be brought to bear effectively on "winning the war" thru the design of posters pronouncing the purchase of war stamps and the necessity of economy and increased production in food.

The teachers of art are fortunate in this opportunity for service because the design of posters offers a suitable and effective method of art instruction.

The most resourceful teacher could devise no better exercise thru which to impress the fundamental principles of design or drawing.

The children of the lower grades can take part in a poster contest quite as well as the more advanced pupils of the high school.

A simple, well arranged announcement in block letters with perhaps a symbol in silhouette, all cut

from colored papers and mounted tastefully, will probably have more emphasis and beauty than a pretentious design representing natural figures. The poster problem can be made suitable to each grade of our schools if the method of execution is adapted to the grade. The one great danger to avoid, as art teachers must know and as pupils are prone to forget, is a too pretentious and elaborate and complex design.

Of course the purpose of those who promote poster contests is not to teach art but to emphasize ideas. The purpose of the war poster contests is to teach patriotic economy and thrift. For this reason no opportunity should be missed to hold local exhibitions of the posters made in the schools. No better work could be exhibited to interest the public in the schools. The aggregate result of school poster exhibits held all over this country, pronouncing our duties to our country in this time of greatest need and danger, is difficult to overestimate.

No such unique and extensive campaign has been attempted thru the schools before and the Art teachers are to be congratulated on their opportunity to direct the army of school children of America to their patriotic and artistic duty.

FOOLING OURSELVES.

WHEN this magazine is before you, the clocks of the land will have been one hour ahead of the sun for at least a fortnight. Probably most of us will have adjusted ourselves to the change and excepting at the noon hour, the discrepancy between sun and clock will not be noticed. There will, however, be a change in our method of living that the parental admonition of our childhood and the guiding conscience of our maturity could not bring about. We will have become a race of "early risers" and probably "early to bedders" and if the old ditty holds true we should be "healthy, wealthy and wise."

Of course the paragon who prided himself on going to bed and getting up early without legislation will be disgruntled. His virtue will have become a national trait and no credit can be given to paragons for doing what everyone does.

Some will possibly be as provincial and insistent as the New Yorker who moved west but did not set his watch two hours back because as he thought "he liked Eastern time best."

There was but one purpose in putting our clock and the sun out of established relation. The purpose was to fool ourselves into a more consistent use of daylight. Now it remains to be seen whether we will retain a beneficial habit or become lie-a-beds in spite of legislation.

PROVOCATIONAL WORK.

A FEW month ago, the *Industrial-Arts Magazine* proposed the use of the term "Provocational" to designate a type of work that previously had been known as "*Pre*vocational" work.

Since that time, we have received numerous letters from well known leaders in the field of industrial education, expressing their warmest approval of this suggestion. Some of the state directors of vocational education have already signified their intention of adopting this terminology.

This is most gratifying, indeed, but the adoption of the term implies something vastly more important, namely, the adoption of a character of work that does not belie the terminology. A considerable amount of the work previously called prevocational could not in any sense qualify as provocational work, which will involve the actual beginnings of vocational insight, method, and operations. Simply to spend a certain number of weeks or months in various shops gaining impressions that may aid in choosing an occupation is not enough. This time must not in any sense be wasted. The experiences gained should be of such a character as materially to set one on his way in the line that he finally selects.

The actual contact with the real problems of industry contemplated by provocational work is at least just as effective, considered as an educational agency, as the undirected, unpurposeful activities possible and often found under the name prevocational.

A type of work is needed that distinctly points toward—*calls forward to*—the actual occupations of adult life, and provocational work contemplates just such courses.

While we earnestly hope that the term provocational may be generally adopted, we are much more anxious that a type of work deserving of the name be more generally introduced into the schools.

DRAWING AND DESIGN.

EVERY one can draw, design or appreciate something. Every one can construct something. Now, why not bring these activities together—the activities of drawing and design—and put them into some bit of construction—literally put them *into* not *onto*. Why not think of these activities in relation to child life, interests and needs? Why not teach design to children making things out of cardboard or textiles or wood? Why not household decorations and pasteboard playhouses? Why not a different emphasis at different ages or seasons or for each sex or for different environment? Why not teach them to appreciate the beautiful whether in calendars, schoolrooms, teachers' dresses, town greens or what not? Why not appreciate construction of good design by making things of good design? Why continue to think that every one must make pictures in order to appreciate, and that children are to consider design as something apart from the rest of the course of study in drawing?—*Arthur D. Dean.*

PROBLEMS AND PROJECTS

The Department of Problems and Projects, which is a regular feature of the INDUSTRIAL-ARTS MAGAZINE, aims to present each month a wide variety of class and shop projects in the Industrial Arts.

Readers are invited to submit successful problems and projects. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing and a good photograph. The originals of the problems in drawing, design, etc., should be sent.

Problems in benchwork, machine shop practice, turning, patternmaking, sewing, millinery, forging, cooking, jewelry, bookbinding, basketry, pottery, leather work, cement work, foundry work, and other lines of industrial-arts work are desired for consideration.

Drawings and manuscripts should be addressed: The Editors, INDUSTRIAL-ARTS MAGAZINE, Milwaukee, Wis.

MAKING Y. M. C. A. GAME TABLES.

James G. Morgan, Supervisor of Manual Training, Franklin, Pa.

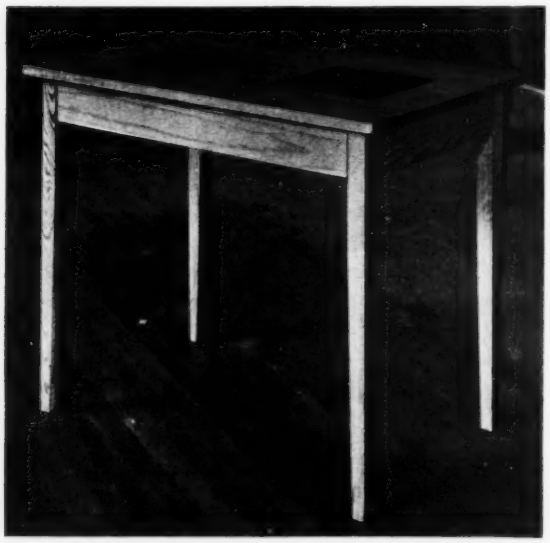
Willingness to grasp every opportunity for helping is the keynote of war service in the schools of Franklin, Pennsylvania. This was illustrated very well during the first weeks of March when the manual arts department was requested to make game tables for the Y. M. C. A. buildings of the army cantonments.

The first problem that arose when the project was undertaken resulted from the desire of practically all the boys to work on the tables. The United States Bureau of Education, in its circular accompanying the drawing and specifications, suggested that only the best workmen be permitted to do the work as the tables are subjected to rough usage and the most accurate work is necessary. The instructor finally allowed as many boys as possible to take part.

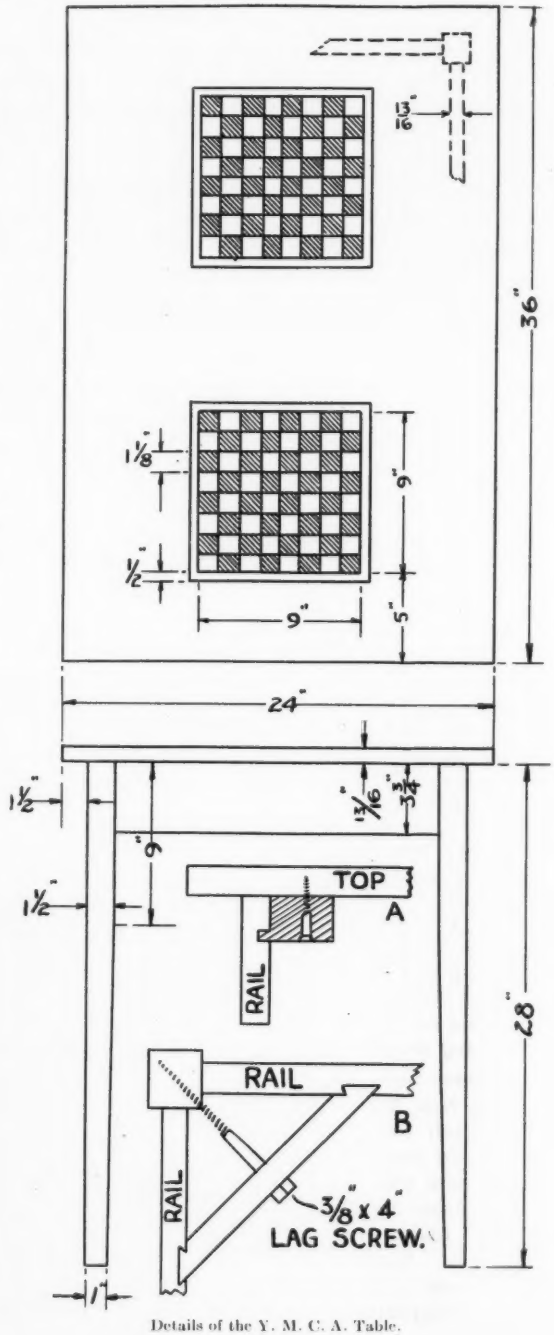
It was interesting to hear the boys discuss the tables. Some thought them too small for four men and declared that only one board should be painted on each table top. Others argued that the Y. M. C. A. buildings were probably crowded and that two boards on each table would accommodate double the number of men at the same time.

The emotions of the boys seemed to be equally divided between the thought that they were doing their bit and the thought that they were making it possible for a great number of men to be entertained. When the class was asked how many tables they would make it was unanimously decided to make the maximum number of ten which the government circular permitted.

The actual work proved to be interesting and inspiring and the boys took hold with enthusiasm. The specifications furnished by the government were followed to the letter. Yellow pine was used and clear, thoroly dried stock was obtained. The tops were glued up of three pieces and the joints were tenoned and grooved. The rails were fastened together by corner braces, dovetailed and glued in place as shown in the drawing at B. The legs were bored and secured to the rails by means of lag screws. The legs were tapered on two sides, near inside edges, beginning nine inches from the top.



A Y. M. C. A. Game Table.



Details of the Y. M. C. A. Table.

The class followed the directions of the government circular in painting the checker boards on the table tops. The boards are nine inches square. Each of the small squares is 1½"x1½". Red and black shellac was used to paint

Boys at Franklin, Pa., and Tables made by them for a Y. M. C. A. War Camp Building.

the squares, and the whole boards were surrounded with a one-half inch gold band. After sanding the tables they were given one coat of white shellac and two coats of flat varnish.

In addition to the tables the class has been making packing boxes for the local chapter of the Red Cross.

A FLY TRAP CONTEST.

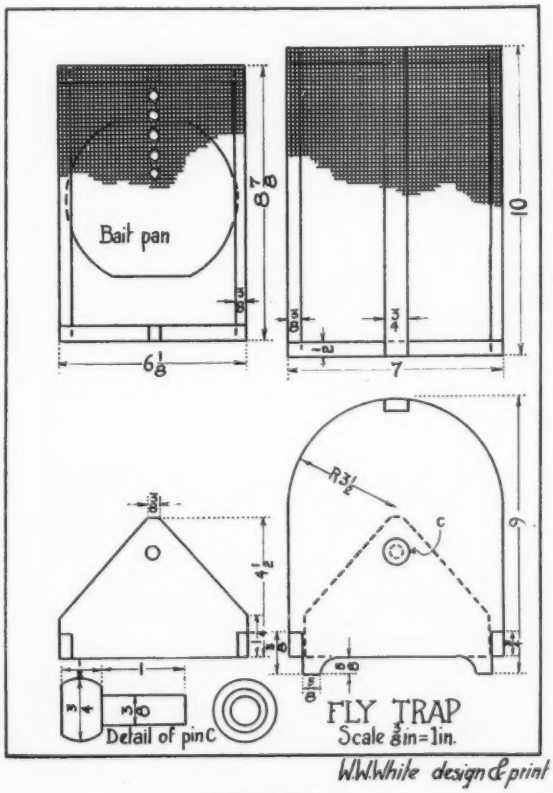
W. W. White, Director of Manual Training,
Lyons, Ia.

A fly trap contest, like a bird house contest, is not only a stimulus to the boys but it is also a great benefit to the community. We are all aware of the menace of the fly.

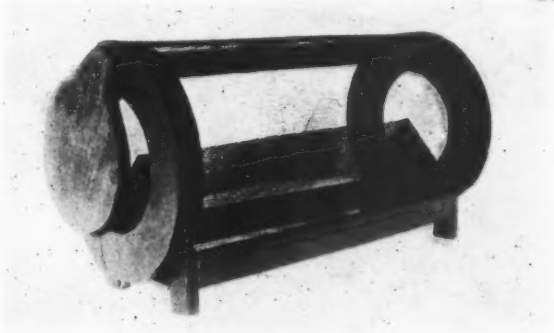
The contest held in Lyons, Iowa, in the spring of 1917 was sponsored by the Commercial Club of the city, which provided $25 to be distributed as prizes. The sum was divided into a large number of small prizes, the largest being only $3.

The high school and the grades were placed in separate classes by themselves and it was arranged that the traps made by the high school students should be original in design, while the pupils in the grades were urged to follow the accompanying drawing.

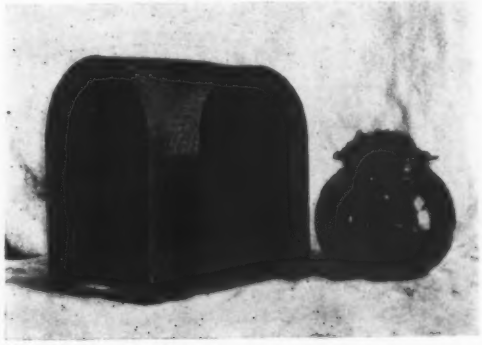
As a means of stimulating interest and confidence in the



Details of Fly Trap.



The Prize Winning Trap.



Trap made by the author as an exhibit to stimulate interest.

trap suggested for the grades, the director of the department made a trap called "exhibit A" and showed it in the school shop with a month's catch of flies.

Twenty of the twenty-five dollars were awarded to the boys who built the best traps. The remaining sum was given in equal parts to the first five boys who brought to the instructor a gallon measure filled with flies caught in their own traps. This provision was made as an incentive to all the boys to set up and care for the traps.

The boys were in each case instructed on the baiting and caring of the traps and while the chief purpose of the contest was the catching of flies, much health information was imparted concerning the flies.

The enterprise was considered a success from every standpoint.

GRINDING WHEEL ATTACHMENT.

Milan G. Twichell, Supervisor of Woodworking Departments, Worcester Boys' Trade School, Worcester, Mass.

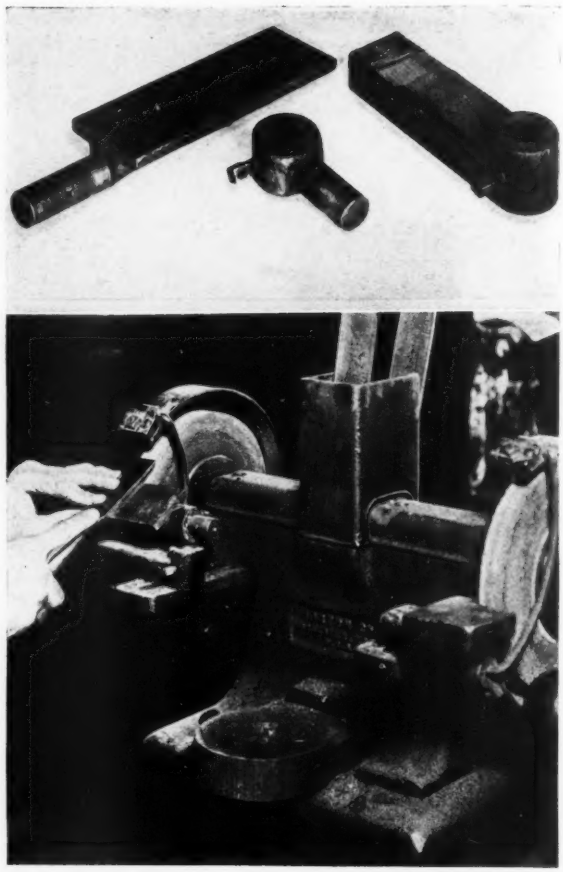
Of the many problems that confront the teacher of vocational work, especially in the workroom, none possibly is more vital than the grinding of the tools. Many years ago we were content (and some are now) to use the grindstone for this purpose. It was, and still is, good; if you have the time to spare.

Today business demands speed in all of its processes and workings, and this applies to the sharpening of tools in the shop and elsewhere. In many places the grindstone has had to give way for the emery wheel, which takes up less space, is a much faster grinder, and, when used by the experienced mechanic, gives excellent results.

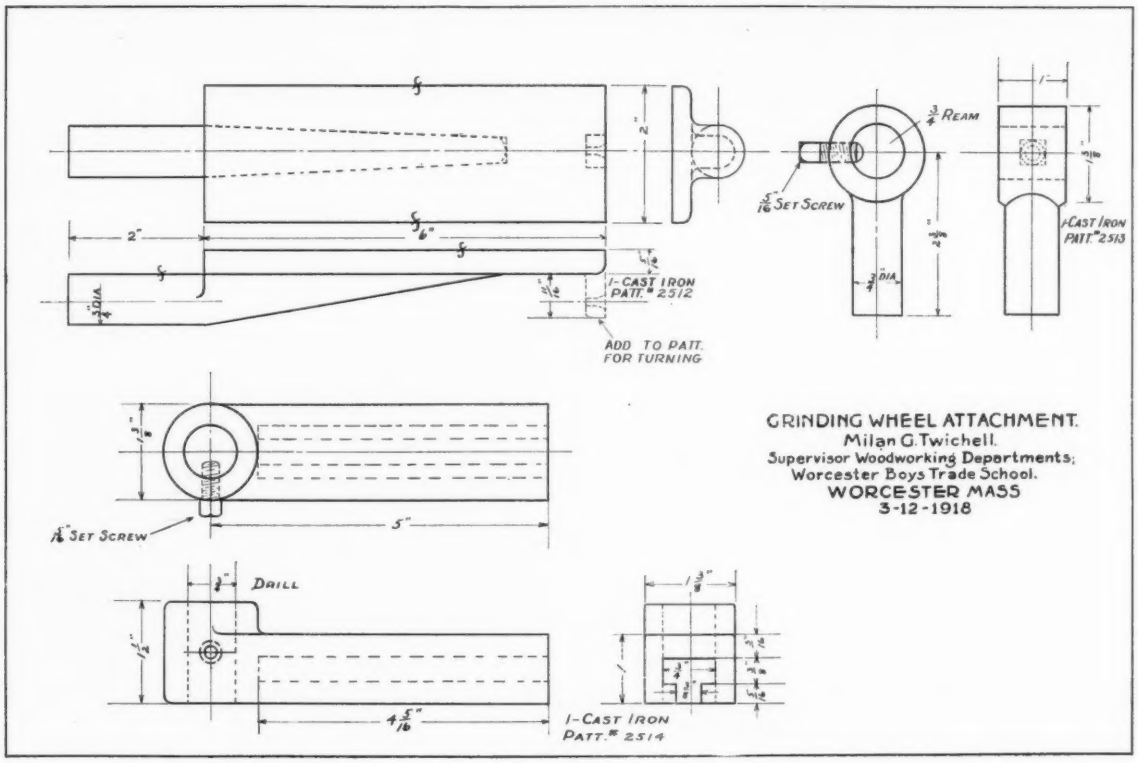
In some schools it is hard to get even the necessary tools with which to carry on the work. This may be caused by the "luke-warmness of the powers that be" or by the lack of funds.

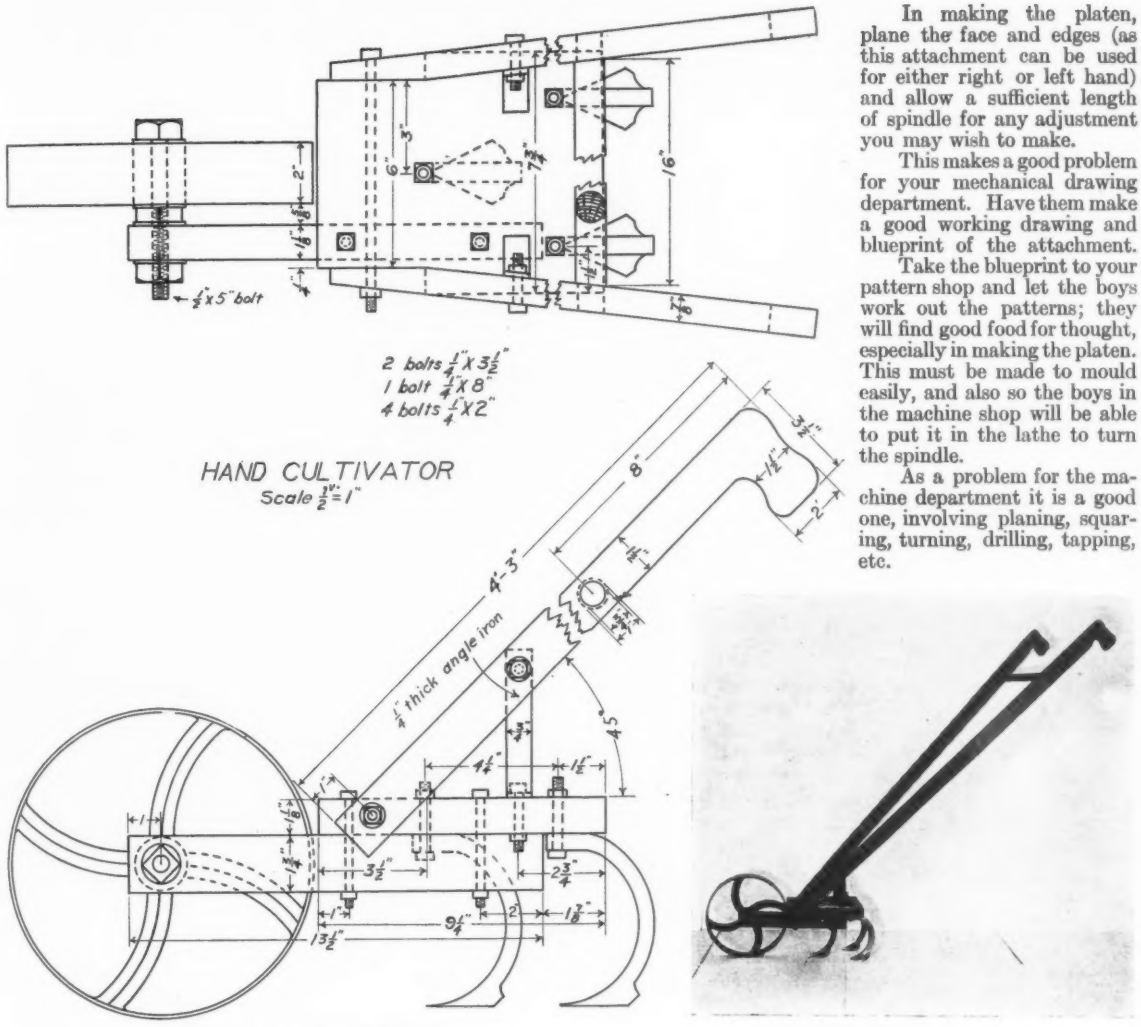
The attachment described in this article is so simple and inexpensive (if you cannot have an iron one, make one of wood) that it is within the reach of any good, hustling vocational school.

Why is it good? Make one, try it a few times, and then you will have the answer. Are you obliged to have sharp tools to do good work? There can be but one answer to that question. If you have an emery grinder, make one of these



Parts of the Grinding Wheel Attachment (above) and the Attachment in use.





Details of Hand Cultivator.

Hand Cultivator.

attachments and put it on the frame. If you do not have a grinder, get an emery wheel, put it in the lathe and use the attachment just the same.

What advantage is this attachment? You can set the platen at any angle to the wheel, for any bevel you may wish to put on the material to be ground. It is so simple and easy to use that your eighth-grade boys can use it, and in a short time do a good job of grinding plane irons, chisels, etc.

This picture taken in our cabinet shop (by one of our instructors, Mr. Anson Vibbert) shows a Norton grinder that is in use every day. All of the boys in the cabinet department are taught to grind their tools on this grinder.

Study the picture carefully (the water reservoir was removed so that all of the attachment would show plainly). Note the correct position of the hands, the right, holding the chisel in the proper manner to steady it in one direction, and the left hand placed so the thumb acts as a guide at the lower edge of the platen; the first two fingers to hold the chisel flat, and the third finger on the edge of the chisel to push t from left to right across the face of the wheel.

By this way you can get a perfect bevel on any of your tools. Notice also that the set screw is placed on the back side of the eye piece where it is not in the way when grinding, but is easily accessible when necessary to turn the platen for different angles.

Read what the instructors in the cabinet department say about it: "It's all right; the best thing we have ever seen on a grinder."

In making the platen, plane the face and edges (as this attachment can be used for either right or left hand) and allow a sufficient length of spindle for any adjustment you may wish to make.

This makes a good problem for your mechanical drawing department. Have them make a good working drawing and blueprint of the attachment.

Take the blueprint to your pattern shop and let the boys work out the patterns; they will find good food for thought, especially in making the platen. This must be made to mould easily, and also so the boys in the machine shop will be able to put it in the lathe to turn the spindle.

As a problem for the machine department it is a good one, involving planing, squaring, turning, drilling, tapping, etc.

A HAND CULTIVATOR.

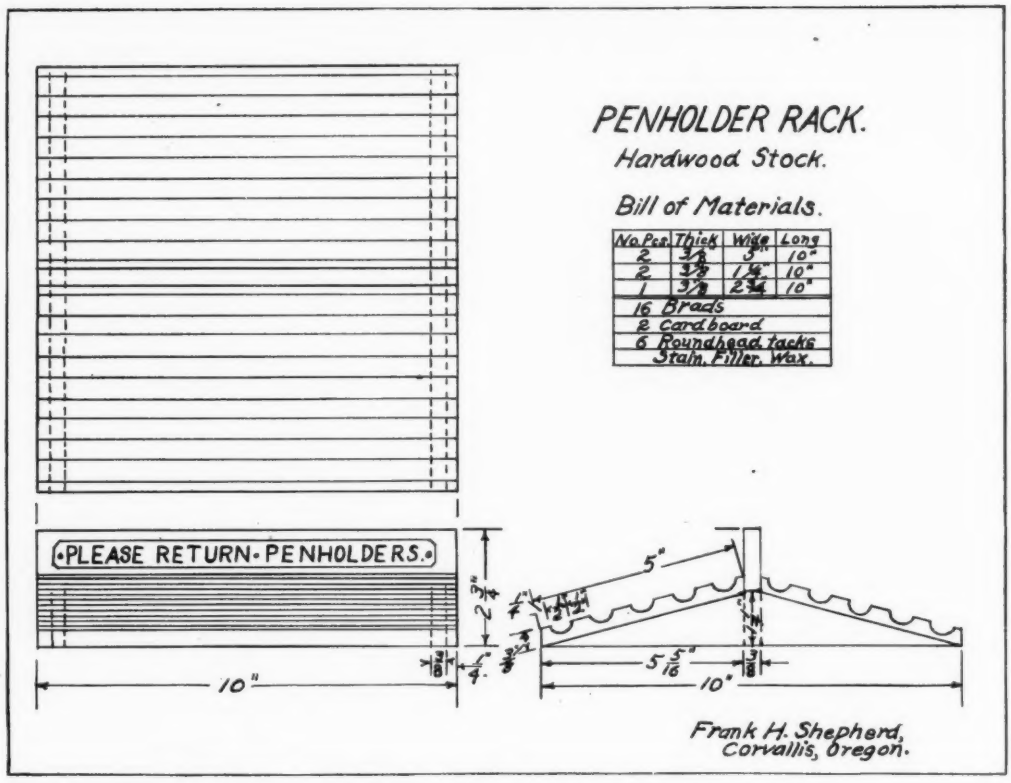
J. W. Eck, Moorhead, Minn.

At this season of the year the young war garden maker's enthusiasm is at its height. He experiences real joy in preparing his seed beds and in planting his seeds with the vision of a bountiful harvest, akin to the pictures in the seed catalogs, uppermost in his mind.

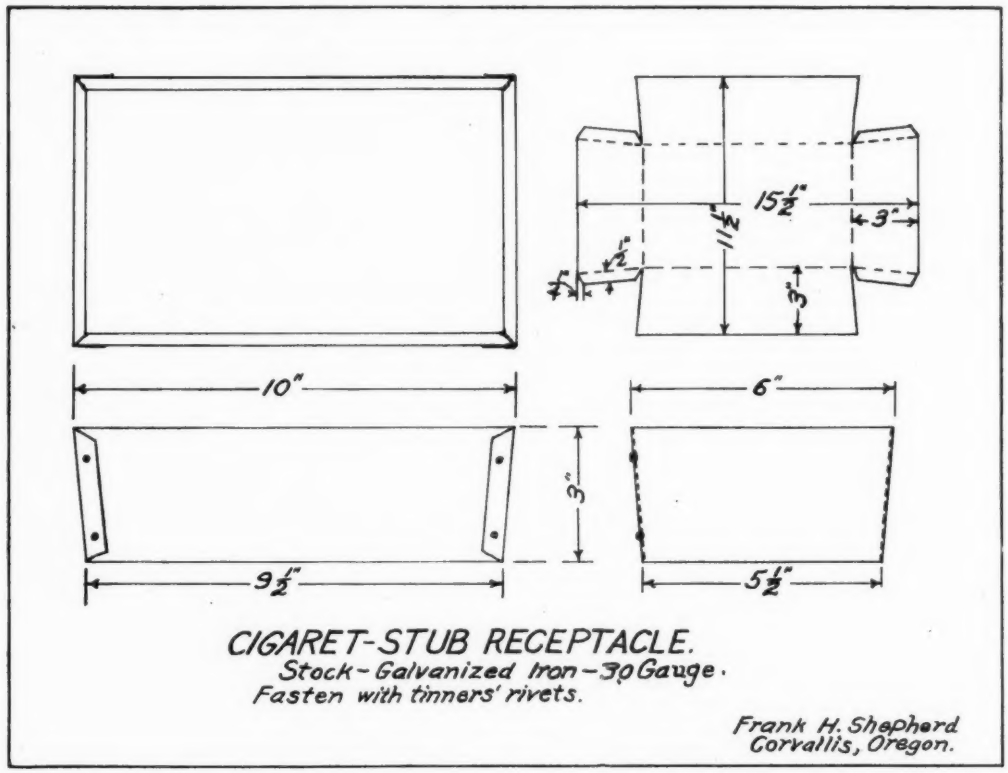
He watches and waits with keen anticipation, but as the days go by he is disappointed to find that the first signs of life are nothing but weeds. A little later he becomes a bit anxious when he finds that the vegetables are having a hard time to catch up to the weeds. Finally, when it is evident that the weeds have the upper hand, he sallies forth with a hoe to the aid of his vegetables.

Now the hoe will kill the enthusiasm of a young gardener long before he has exterminated the weeds in a fair sized garden. But give him the proper tool and cultivating the garden becomes real sport.

The drawing and photograph show such a tool, called a hand cultivator. This design is so simple that it requires little explanation and can be worked out by an eighth-grade boy. Oak was used in making this project. The wheel was an old pulley picked up in a junk heap. Three Planet Jr. cultivator teeth were purchased from an implement dealer at a cost of forty cents each. Other equipment may be purchased and used in place of the teeth, such as plows, rakes, and hoes. For most work the teeth give the best service.



DETAILS OF PENHOLDER RACK FOR Y. M. C. A. WAR CAMP CENTERS.



DETAILS OF GALVANIZED IRON BOX FOR Y. M. C. A. WAR CAMP CENTERS.

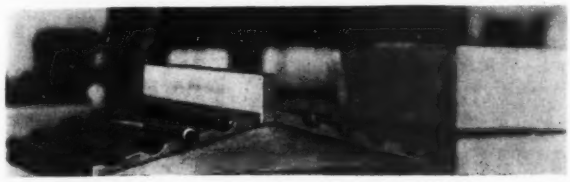
TWO ARTICLES FOR Y. M. C. A. CANTONMENT BUILDINGS.

Designed by Frank H. Shepherd, Oregon Agricultural College, Corvallis, Ore.

A request from a Y. M. C. A. secretary in one of the large cantonments caused the United States Bureau of Education, thru Dr. Wm. T. Bawden, to request Prof. Frank H. Shepherd to design the articles illustrated in the accompanying drawings.

The pen holder rack is an exceptionally good problem for seventh and eighth grade boys. It is made of hardwood, preferably oak, walnut, or maple. Any thickness will serve, but for economy ¾" stock is recommended.

For making the grooves, a one-half inch bit in a combination Stanley 55 plane should be used. If this tool is not available or cannot be borrowed from a local carpenter or cabinet



Penholder Rack and Cigaret-Stub Box for Y. M. C. A. Buildings.

maker, it is a simple matter to grind down a planer bit and use it in an ordinary plane stock. One can set a clamp on the wood to use in place of a fence.

The holder rack should be fastened together with brads and all brad holes should be filled with sawdust and glue. The wood may be stained, filled and given a coat of wax.

The metal cigaret-stub receptacle is a necessity in the Y. M. C. A. buildings because the majority of soldiers smoke and wooden boxes are unsatisfactory because of their inflammability.

The box suggested will interest any class in elementary sheetmetal. The tools required are a tinner's snip, a punch and a hammer. The flare is introduced so that the boxes may be nested for shipment.

In the shop it will be well to make a full-size cardboard or paper pattern so that the angles are correct and the boxes are uniform in size. After the 30-gauge galvanized iron is cut, the rivet holes should be located and punched. The metal should then be bent on the dotted lines shown in the development. A hardwood block, an anvil and a mallet are used for the final shaping and riveting.

If a school undertakes the construction of fifty or more, wooden jigs may be worked out for reducing the labor and time of bending.

AN ECONOMICAL SLEEVE BOARD.

Wm. P. Taugher, Milwaukee, Wis.

Unnecessary waste of lumber often can be avoided by proper planning in the laying out of projects to be constructed. As an instance of this, the writer presents the "Sleeve Board" shown in the accompanying drawing.

By the addition of four inches to the length of the bottom piece, the top can also be secured if laid out as indicated. This represents a saving of a 6"x16" piece of lumber without decreasing the strength in any way.

The size shown will serve the average needs but the same idea may be carried out in larger or smaller sizes. The corners of the base may be left round or square at the option of the pupil.

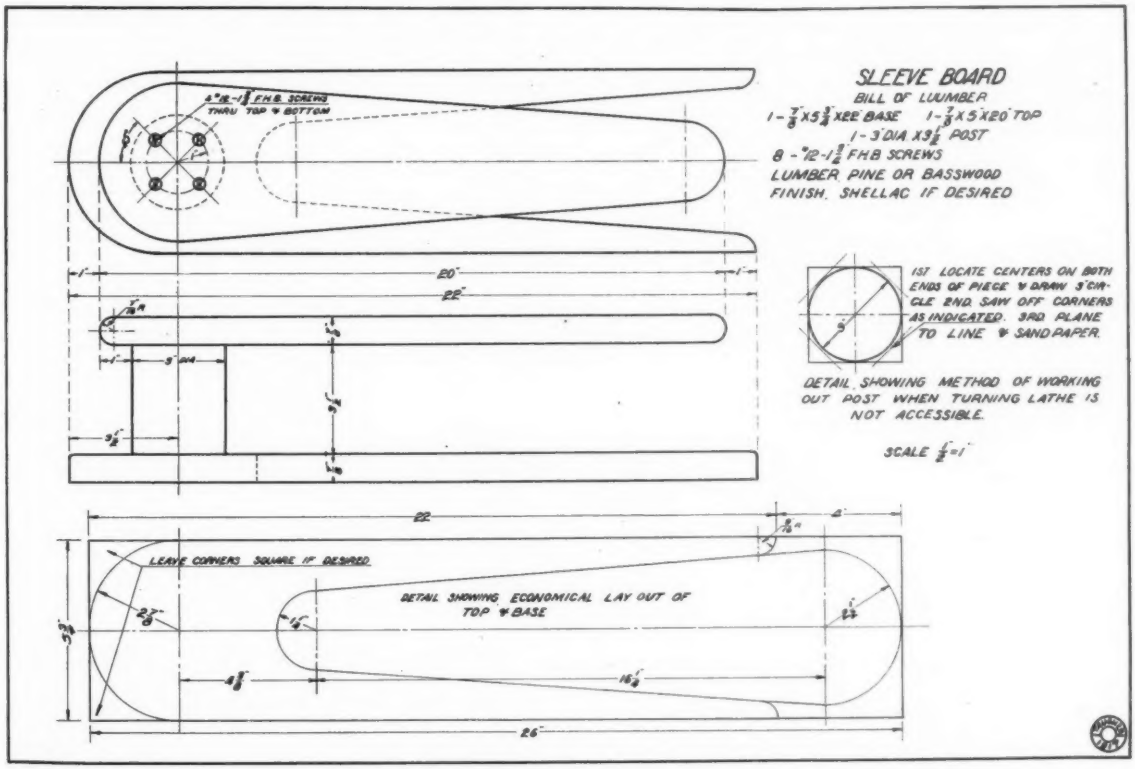
A STEP LADDER.

D. V. Ferguson, St. Paul, Minn.

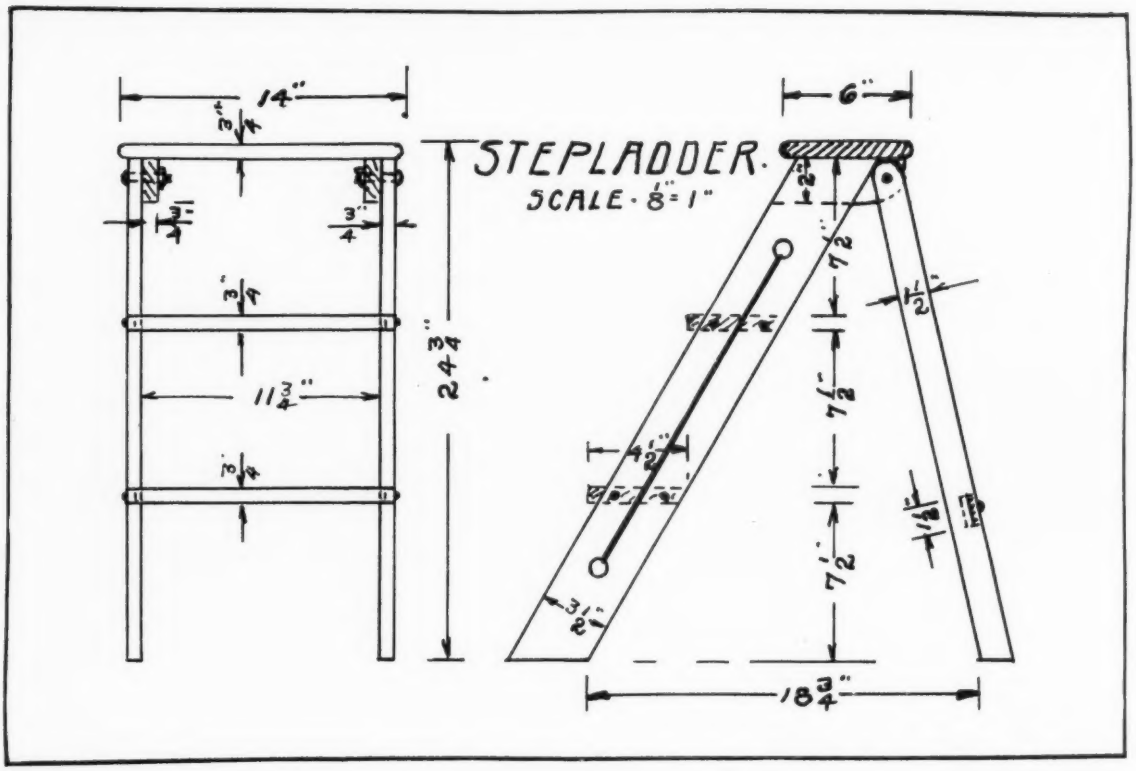
An extension kitchen ladder makes an excellent seventh-grade problem that will interest boys because of its utility in the home. The ladder illustrated is made up in pine, screwed and glued together and each step is firmly housed in on both sides. A small chain running from the lower step to the center of the stretcher at the back, is used to prevent the ladder from spreading too far. The project involves the use of a great variety of tools and processes.

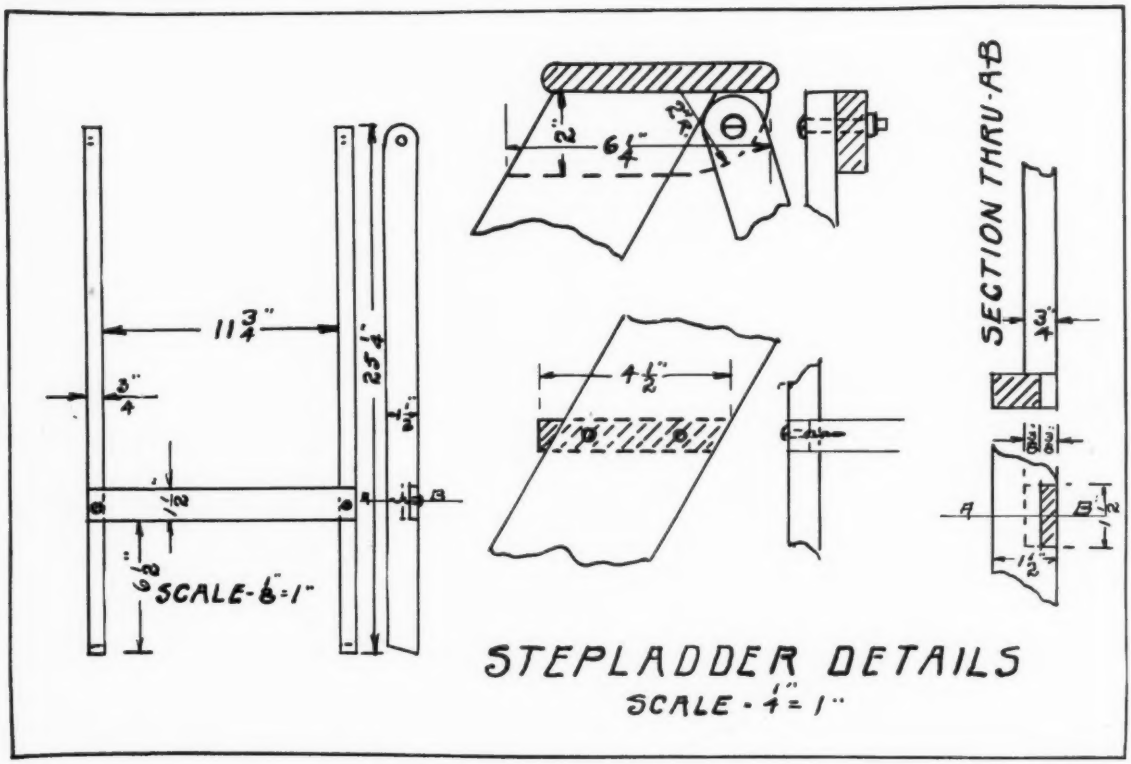
ROCHESTER BOYS AID IN RED CROSS WORK.

The boys in the manual training classes in several of the Rochester, N. Y., schools have been busy making knitting looms for the knitting of trench socks, wristlets, scarfs and


SLEEVE BOARD
BILL OF LUUMBER
1-⅞X5¾XEE BASE 1-⅞X5X20 TOP
1-3 DIA X3½ POST
8-#12-1½ FH.B SCREWS
LUMBER PINE OR BASSWOOD
FINISH. SHELLAC IF DESIRED
4#12-1½ F.H.B. SCREWS THRU TOP & BOTTOM
20
22
1ST LOCATE CENTERS ON BOTH ENDS OF PIECE & DRAW 3 CIRCLE END. SAW OFF CORNERS AS INDICATED. 3RD PLANE TO LINE & SAND PAPER.
DETAIL SHOWING METHOD OF WORKING OUT POST WHEN TURNING LATHE IS NOT ACCESSIBLE.
SCALE ½=1
LEAVE CORNERS SQUARE IF DESIRED
DETAIL SHOWING ECONOMICAL LAY OUT OF TOP & BASE
26

DETAILS OF SLEEVE BOARD DESIGNED BY MR. WILLIAM P. TAUGHER.





sweaters. Splints of all kinds are also being made for the boys "over there." Several of the schools are making and selling toy furniture, the profit on the articles sold being used for Red Cross purposes.

Anyone desiring further information regarding the knitting looms may secure the same by writing to Raymond C. Keople, Department of Public Instruction, Rochester, N. Y.

ELEMENTARY MANUAL TRAINING TEACHERS CLUB OF CHICAGO.

This club was organized shortly after manual training became a part of the curriculum in the Chicago schools.

The character of its organizers is best shown by the fact that they have so largely reached positions of honor in the public service. One has served two terms as city alderman, another is the head of commercial work in Chicago schools and about twenty have positions in the Chicago high schools at present.

The club has never deviated from the plan of its founders to avoid all political alliances, engage in no factional controversies and to work solely for the good of the department they represent.

Joining various educational bodies in a plan for more unity of work it has, during late years, had headquarters in the Malleir Building where the Principals' Club has a beautiful assembly room opening into a number of smaller rooms used as headquarters by practically every organization of the Chicago teachers.

Visiting teachers are always welcome and all departments, from principals to kindergarten, keep open house for their fellow workers.

The meeting of the Manual Training Club, March 9, was a fair example of the character of our work. The general topic was "Printing in the Public Schools" from the viewpoint of a commercial teacher.

Mr. Sheldon, who has had charge of the apprentice classes in printing in the Lakeside Press Company, told the methods they pursue in fitting the young workers in that great plant to rise to higher positions in the firm and to find more joy in their work.

Samples of work done by students, as well as the most perfect samples of the printers' art, gave practical help to the many teachers of printing present. The methods of instruction outlined were helpful to all teachers, as they helped in the teaching of any subject.

A demonstration of the use of a certain motor driven band saw, small enough to move from bench to bench and as efficient as the larger types in the school shop, was suggestive of what can be done at moderate cost to give the boys a working knowledge of labor saving tools.

The use of moving pictures in the school was demonstrated with a small but very satisfactory portable projecting machine coming into general use.

A report of the funds raised thru the sale of work made by boys in the elementary shops and sold at the club rooms showed nearly $500 thus raised for the Red Cross and in addition a liberal donation of socks, etc., was sent to each of the many manual training teachers from Chicago now at the front.—*Heman J. Barber.*

SECOND ROUND TABLE MEETING OF SCHOOL CRAFTS CLUB.

The School Crafts Club of New York held its second round table meeting February 16th, at the Broadway Central Hotel. The fifty members present listened to five round-table talks by fellow workers in the manual arts field.

At the first round table, Mr. W. A. Carter, of New York City, spoke on "Teaching Material and the Shop Museum." Mr. Carter showed models for woodworking projects which were capable of being transformed into different projects thru the rearrangement of different parts. He pointed out that the pupil is not restricted to a set of projects, but by clever adaptations may make a number of problems.

Mr. E. F. Judd, of Montclair, who presided at the second table, described the "Construction of a Wattless Transformer and Motor." The motor, he said, may be made in a variety of sizes and may be run on house current. Jigs for making parts and winding armatures were shown and described by Mr. Judd. The motors with transformer offer practical lessons in electrical work and are capable of varying voltage and amperage. Each year in Montclair, at the spring field day of the schools, the interesting feature is the motor boat race. The boats are equipped with motors made in the Montclair school shops.

Printing Class in the School Print Shop, Asbury Park, N. J.
(See page 185)

"Forging in the School Shop," which was discussed by Mr. Russel F. Hennion, of Paterson, N. J., was ably presented at the third table. Mr. Hennion pointed out that the forge work in Paterson seeks to hold the interest and fill the need of the boys who take the work. The boys make articles of iron which are adapted for home use and which involve processes in forging applicable to high school work. Mr. Hennion was prepared to issue copies of a complete course of study worked out in connection with his experience at Paterson.

A most timely subject was that of Mr. Theodore Struck, of Orange, N. J., who talked on "The Continuation School as an Agency for Meeting Present Demands for Vocational Education." The subject called for the presentation of a number of theories and ideas and brought before the members the question of compulsory attendance and legislation for putting the work on a firm basis. The members agreed that the subject was so extensive that it could not be settled in its entirety but they felt that the continuation school should be made a national institution, bringing much help to those in the trades who need this kind of training.

Mr. Lawrence J. Young, of New York, who led in the fifth round table, gave an interesting talk on "Shopwork in Democracy and Democracy in Shopwork." Mr. Young's talk was based on his experience in New York school shops and he told how he had changed from the command method to the suggestion method of teaching his pupils. Mr. Young pointed out that it is much easier to lead a boy than to drive and he proved that more benefit is derived thru kindly criti-

If an Artist makes a W.S.S. poster
and shows it to his Teacher, and she sends it to the Committee,
it will be put up where other boys and girls can see it
and it will make them want to BUY
THRIFT STAMPS
PASSED BY THE NATIONAL BOARD OF PATRIOTISM
NATIONAL WAR SAVINGS POSTER

ILLUSTRATION USED IN ADVERTISING POSTER COMPETITION IN MILWAUKEE SCHOOLS.
Prepared by Miss Madge Anderson, Chairman of Wisconsin Committee in Charge of Competition.

cism and wise counsel than thru harsh or driving methods. He also discussed the kind of teacher best fitted to understand the boy and to incite him to work. He said that the tradesman-teacher must be counseled by his fellow teachers in order that he may not overshadow the educational advantages of his subject thru commercial excellence. Associate teachers should help these skilled mechanics so that they may make excellent teachers.

The summing up of all the round tables before the members gave an insight into the work of the evening and all went home with new thoughts for the betterment of their work.

—*R. A. Loomis.*

THE DETROIT CLUB MEETS.

The regular monthly meeting of the Detroit Manual Training Club was held at the Board of Education rooms, Friday, March 15th.

Mr. E. G. Allen, head of the mechanical department, Cass Technical High School, gave a report on the meeting of the National Society for Vocational Education held at Philadelphia, Feb. 21st to 23rd. It is always a pleasure to listen to Mr. Allen. He always has something good to offer and does it in an aggressive manner that is very pleasing to his hearers. Three very important points were made by Mr. Allen upon this occasion, as follows:

First: The society has gotten beyond the *promotion* idea. It is now on an *established* job.

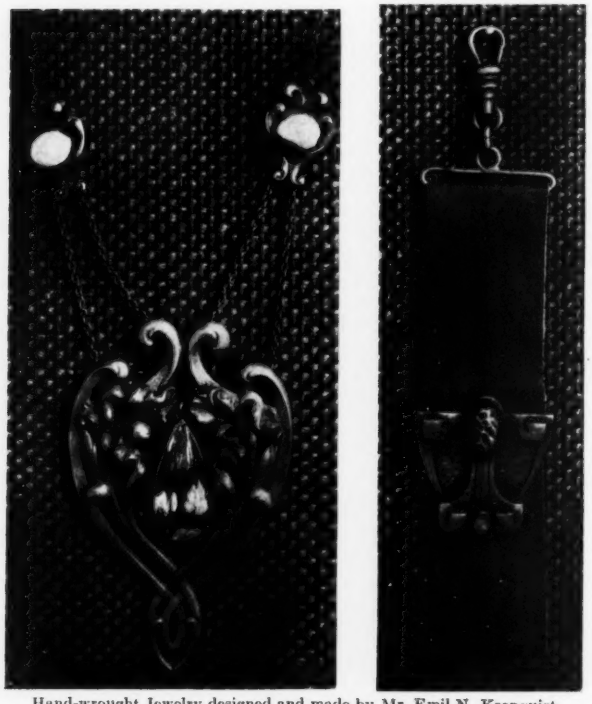
Second: Realization of the necessity for industrial training on a larger scale than heretofore. A greater variety of subjects to be included.

Third: Continuation schools, both day and evening, will be the largest development in the next ten years.

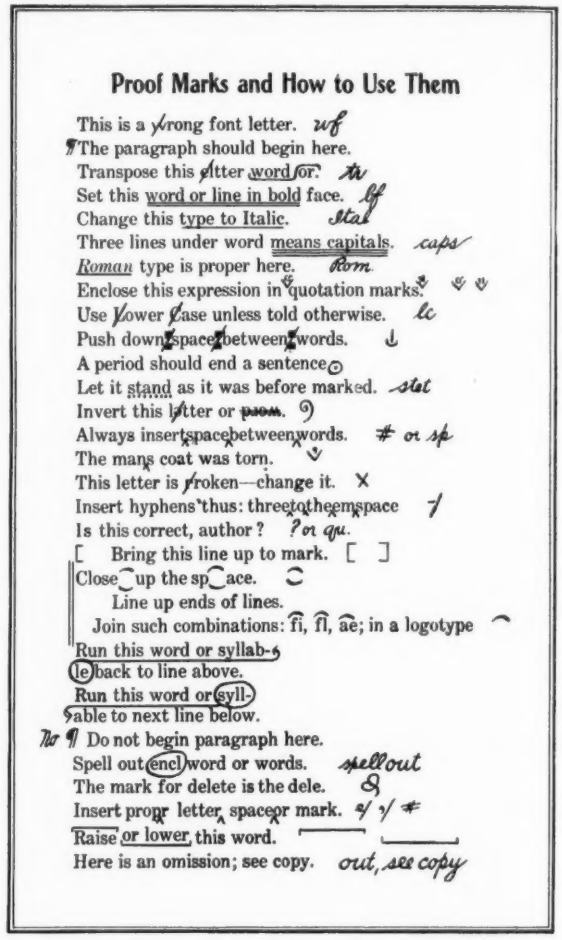
Dr. George E. Meyers discussed the application of the Smith-Hughes law to the state of Michigan, giving to the members a better idea of the scope of the work to be done under the provisions of this law. The University of Michigan has been named by the Federal Board to train teachers for this state and Dr. Meyers has charge of this work at the university. Both speakers brought out the fact that the country is at the beginning of a great industrial movement.

An effort is to be made by the club to increase the amount and scope of required vocational work in the high schools.

The service flag of the club bears 29 stars as evidence of the response of the members to the service of their country.



Hand-wrought Jewelry designed and made by Mr. Emil N. Kronquist, Instructor of Manual Training, Washington High School, Milwaukee, Wis.


Proof Marks and How to Use Them
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Transpose this litter word for. tr
Set this word or line in bold face. bf
Change this type to Italic. ital
Three lines under word means capitals. caps
Roman type is proper here. Rom.
Enclose this expression in quotation marks.
Use lower case unless told otherwise. lc
Push down space between words.
A period should end a sentence.
Let it stand as it was before marked. stet
Invert this letter or mom.
Always insert space between words. # or sp
The mans coat was torn.
This letter is broken—change it. X
Insert hyphens thus: three to the em space
Is this correct, author? ? or qu.
[Bring this line up to mark. [ ]
Close up the space.
Line up ends of lines.
Join such combinations: fi, fl, ae; in a logotype
Run this word or syllab-
le back to line above.
Run this word or syll-
able to next line below.
No ¶ Do not begin paragraph here.
Spell out encl word or words. spell out
The mark for delete is the dele.
Insert proper letter, space or mark.
Raise or lower this word.
Here is an omission; see copy. out, see copy

List of Printers' Marks prepared by Mr. Ralph A. Loomis.

INDUSTRIAL ARTS AND HOUSEHOLD ARTS SUBJECTS IN JUNIOR HIGH SCHOOLS.

Mr. Ralph W. Westcott, superintendent of schools at Mansfield, Mass., prepared in February a detailed questionnaire on junior high school practice. As a result he has received replies from 106 communities where junior high schools are organized, of which 101 superintendents of schools expressed themselves as being satisfied with the results achieved. Mr. Westcott found that prevocational subjects are offered in eighty of the schools as follows: Sewing, 80; woodworking, 78; cooking, 75; typewriting, 43; agriculture, 38; stenography, 31; printing, 28; basket weaving, 23; bookbinding, 17; iron working, 14; electric wiring, 12; pottery, 12; plumbing, 8; mechanical drawing, 4; bookkeeping, 4; concrete and cement, 3; dressmaking, 3; sheet metal, 3; millinery, 2; art, 2; music, 2.

The following were each offered in one town only: Pipefitting, pattern making, moulding, chipping and filing, plastering, house construction, machine shop practice, sign painting, garment design, power machine operating, novelty work, homemaking, house repairing, chair seating, telegraph, general office work, shoe mending, and tinning.

COMMENDS REPLY.

To the Editors: I want to commend you for your timely answer to question No. 705 in the October number of the *Industrial-Arts Magazine* in regard to writing furniture houses for their catalogs. A great many manual training instructors do not stop to think of the very points that you so ably brought out. There are plenty of books that they might buy from publishers out of which they could get the very information they seek.

Your question and answer columns are very interesting and instructive.—*Herbert N. Alleman.*

NOW, ARE THERE ANY QUESTIONS?

This department is intended for the convenience of subscribers who may have problems which trouble them. The editors will reply to questions, which they feel they can answer, and to other questions they will obtain replies from persons who are competent to answer. Letters must invariably be signed with full name of inquirer. All questions are numbered in the order of their receipt. If an answer is desired by mail, a stamped envelope should be enclosed. The privilege of printing any question and reply is reserved. Address, Industrial-Arts Magazine, Milwaukee, Wis.

Printing Specimen Magazine.

773. Q.—In one of your periodicals you speak of "The Printing Art Suggestion Book," a quarterly. Can you tell me where I can purchase it?—*J. E. B.*

A.—The Printing Art Suggestion Book is published quarterly by the University Press, Cambridge, Mass. The subscription price is $1 per year. The publishers describe it as "an illustrated magazine containing helpful hints and suggestive ideas regarding the use of papers, inks, engravings, printing processes, etc."

Wire Shades.

774. Q.—Could you inform me where wire shades can be bought or completed shades covered with silk, cretonne or other cloth material? Do you know of any phonograph company which will install phonograph machinery in a home-made box or cabinet.—*R. D. W.*

A.—The house furnishing department of any large department store or furniture store can supply you with wire shades for electric lamps. Why not have your boys make the shades? It requires only plain iron or copper coated wire and pliers bought from your hardware man or milliner. The girls in the sewing classes can sew the cretonne or the silk.

The American Phono Parts Co., 535 W. 35th St., Chicago, will sell you a high-grade movement for a phonograph.

Twisted Top.

781. Q.—I have glued a gum wood piano bench top and it has begun to twist. Is there any way of taking this out? The twist is not very bad.—*W. M. F.*

A.—Regarding the piano bench top of gum wood which has begun to twist, I am going to suggest that if the correspondent has a machine saw of the circular type that he use it in the manner herein suggested.

If the top is of ⅞ or ¾-inch material, set the saw for half an inch cut and with it cross-cut the under side of the board on that portion which would be above a plane surface if the bench top were laid down flat. Let these saw cuts run toward the center of the board and be about an inch and a half apart. When the bench top is subsequently fastened to the frame these saw kerfs on the under side of the board will close to some extent and the high corners are drawn down and fastened in place. These slight cuts can be subsequently filled up with some kind of stopping to match the stained wood, or, better still, the edge may be veneered with a facing of one-sixteenth inch gum to match, provided the edge of the bench is not beaded or moulded.

Some years ago when working in a contracting shop, an order came in for a special lot of an inch and a half maple top counters. The lumber was late in arriving and when received was placed in the wrong kiln by mistake, with the result that when the kiln was pulled two days later, the maple was badly warped and twisted. It was out of the question to get new material. The contract had to be filled or indemnity be paid; therefore, I endeavored to save the material as best I could.

By alternating the straightest material with the most crooked and by sawing the latter as suggested above, in such a manner as to allow the kerfs to close when the material was held down tight and straight, I was surprised to find that when these tops came thru the planers and sanders they were as handsome as could be produced by the most select material. Today these tops are in good condition and have given satisfactory service.—*Ralph G. Waring.*

Blueprints.

792. Q.—Kindly refer me to a concern where I can obtain blueprints of all descriptions, particularly of bookcases and furniture.—*W. W.*

A.—Blueprints of furniture of all descriptions are published by the following firms: Dewey Blueprint Co., Denver, Colo.; C. F. Pease, Chicago, Ill.; Manual Arts Press, Peoria, Ill.; Homecraft Co., Grand Rapids, Mich.; A. P. Laughlin, Peoria, Ill.; F. C. Chute, Bellingham, Wash.

Motion Picture Films.

798. Q.—Where can I obtain slides and films depicting the manufacture of various articles of common use?—*A. K.*

A.—Slides of modern manufacturing processes are practically unobtainable. Films which show the processes completely have taken the place of still pictures.

If your school is not near a state university extension circuit, I would suggest that you obtain films directly from the manufacturers, who are prepared to loan reels without cost, or from the National Bureau of Visual Instruction, Leon A. Tarhof, assistant director, Washington, D. C. A complete list of free films is issued by the Educational Department of Henry Disston and Sons, Philadelphia, Pa. The bureau just mentioned furnishes films at the cost of transportation.

Excellent film service may also be had thru the Atlas Educational Film Company, 63 Adams St., Chicago; Arthur E. Curtis, 16 W. Jackson Blvd., Chicago; Lincoln and Parker Co., Inc., Worcester, Mass.; American Film Co., Inc., 6235 Broadway, Chicago; Autopticon Co., 203 S. Dearborn St., Chicago; Educational Film Corp., 729 Seventh Ave., New York, N. Y.; Community Motion Picture Bureau, 46 W. 24th St., New York, N. Y.; Camel Film Co., 3715 Grand Ave., Chicago; Venning P. Hollis, 3035 Irwing Ave. So., Minneapolis, Minn.; The Lea-Bell Co., Shiller Bldg., Chicago.

Dry Color Stains.

797. Q.—I desire to know just how to mix "dry color stains" to produce the various colors. For example, to produce a light oak or golden oak, what proportion of dry colors are used with the boiled linseed oil, thinned with turpentine? On what various woods would you recommend the dry colors to be used?—*W. C. H.*

A.—Strictly speaking, dry colors are not stains but pigments. That is to say they are insoluble in water, spirit, or oil, and therefore do not stain wood material in the sense that is permeated by a dye, as implied by the use of the last term. Dry colors, or colors ground in oil, are paint colors and it is really a form of paint which the user of this type of coloring matter applies to his work in order to produce the desired effects. The very coarseness of the material precludes any possibility of its going into solution and producing a stain. It does, however, *color* the wood to which it is applied in that all the pores become filled or clogged with the coloring material and thru refracted light show a condition of color.

Therefore, it is only on such open-pored woods as oak, chestnut, walnut, butternut, ash, mahogany, and similar woods that this practice finds application in the effort to produce color on wood. True it is that such woods as pine and basswood may absorb some of the more finely ground materials in the pigments and assume a form of color which, however, will not partake of all the colors to be derived from the various materials used. It is far better practice in the majority of cases to use a water soluble stain material which, after application and drying, is followed by a thin coat of shellac reduced one-half with alcohol, and this in turn followed by the use of a filler properly compounded from pigment colors in connection with a silex base. The following formula for the production of golden oak will illustrate the point in question:

Make up a solution of one-half cup or two ounces of golden shade black asphaltum varnish, to which after thoroly mixing, add one tablespoonful of Japan drier. Stir well and then brush on the oak, allowing to remain until the turpentine has lost its gloss. Over this apply directly without the use of a shellac coat, filler made in the following proportions. To one quart of turpentine add one pound of raw sienna, dry;

one-quarter pound dry raw umber; one-quarter pint dark Japan drier; two pounds of silex or Wheeler's light wood filler and enough turpentine or gasoline to reduce to the consistency of skim milk. This should be brushed on across the grain with an old stubby brush and when set enough to lose its turpentine gloss, should be forced into the pores with a leather or similar smooth pad in order that the filler may properly level up the pores. Eight-inch squares of burlap should now be used to further clean up the work across the grain in order that the excess filler may be removed. Following the burlap, clean unbleached muslin or similar matrial free from lint should be used to remove the last vestige of cloudiness from the surface, care being exercised to avoid pulling out the filler from the pores. All filler should dry at least 48 hours before varnishing and should be sanded lightly with 00 paper after drying, in order to produce a clean surface free from spots of filler. After dusting off, a very thin coat of orange shellac should be given in order that the varnish may not work into the filler in the pores. After three hours drying and sanding, follow with the usual number of varnish coats.

The following colors are particularly applicable to this class of color productions: Raw and burnt sienna, raw and burnt umber, French ochre (not yellow ochre, an entirely different material) Vandyke brown, chrome yellow, chrome green, and rose lake. These should be used as previously directed in connection with a silex base. I object to the use of boiled linseed oil, as this produces a sticky working filler which is apt to pull out while being rubbed with burlap. It is best to mix these materials comparatively fresh in order that they may retain their free working qualities. Above all things, do not leave a can of filler exposed to the air, for it will rapidly harden and deteriorate. It is suggested that these colors be purchased ground in oil since they are more easily mixed with the turpentine and require much less bulk than dry color in order to produce the desired shade.—*Ralph G. Waring.*

SAFETY FOR THE HOUSEHOLD.

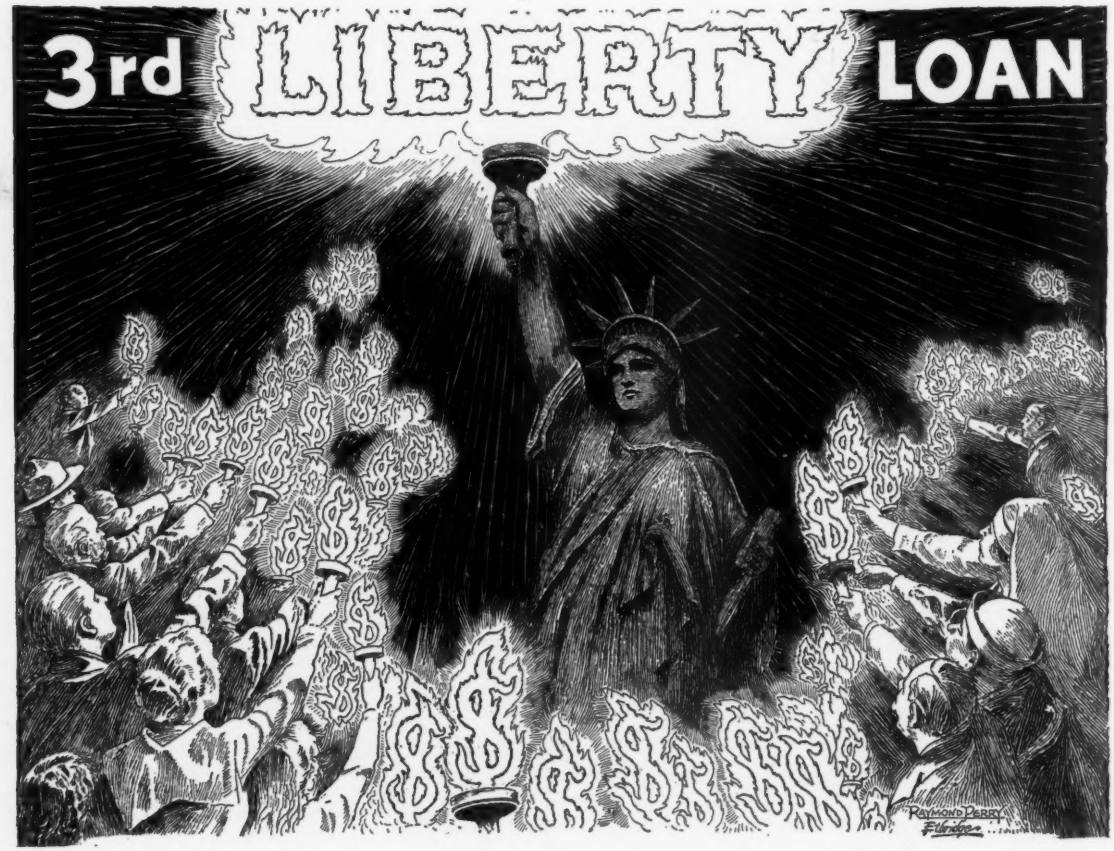
The safety of the home is the subject of a new pamphlet just issued by the Bureau of Standards, Department of Commerce, entitled "Safety for the Household, Circular No. 75." An interesting account of household hazards is given. The topics are discussed clearly in a manner which would afford a basis for popular education in "Safety First." The dangers from electricity, gas, fire, lightning, household chemicals, and the other common causes of accident are recited and many actual cases are described. The purpose is to aid in removing needless risk and fear, and to develop intelligent caution where the hazard cannot be entirely avoided.

The hazards of the home have increased in modern times from the service of gas and electricity and the use of such dangerous articles as matches, volatile oils, poisons, and the like. The use of energy in the home necessarily involves some risk which intelligent planning and care will reduce to a minimum.

Caution alone is not enough, since many of the dangers are not even suspected. The nature of such unknown hazards must be made plain. The circular emphasizes the seriousness of some of the risks not generally known, gives simple cautions, and aims to guide the formation of habits of carefulness. The circular also suggests effective home equipment to minimize the risks involved, and aims to encourage public measures to provide safety for the household and community.

It is intended, not to increase fear of accident, but rather to remove the causes and the need for alarm. The sense of safety to be gained by observing these cautions would alone justify the careful study of this new circular. This circular completes the series of three popular household circulars which deal with measurements, materials, and safety. These form a valuable addition by the Bureau of Standards to the literature on household management.

The appalling loss of life from avoidable causes and injury to persons and property make the pamphlet especially timely. Copies of this circular can be purchased at a nominal cost of 15 cents per copy from the Superintendent of Documents, Government Printing Office, Washington, D. C.



KEEP THE LIGHT BURNING.